HEATING & VENTILATING
AIR CONDITIONING

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FOR JULY, 1937

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This month's cover—Celebration at the signing of the lease for Harlem River Houses, $4,219,000 PWA low-rent housing project for Negroes in New York City, June 16. The one-year lease was turned over to the City of New York by the Federal Government, marking the first time that the Government and a city have gone into partnership in the operation of an apartment house. The building has 574 apartments, 24 stores, and social and recreational centers. Photo by Acme.

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning.

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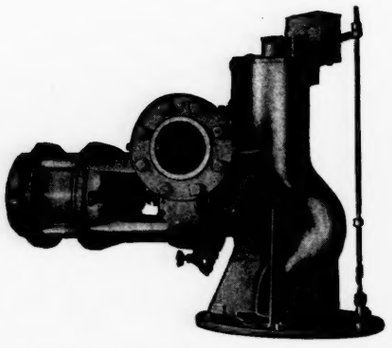

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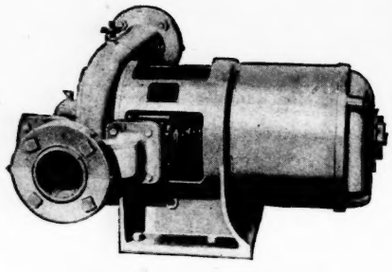

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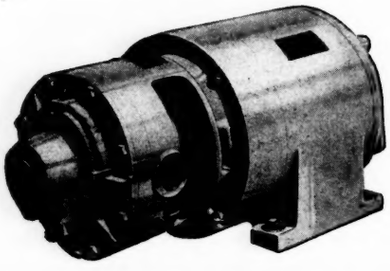

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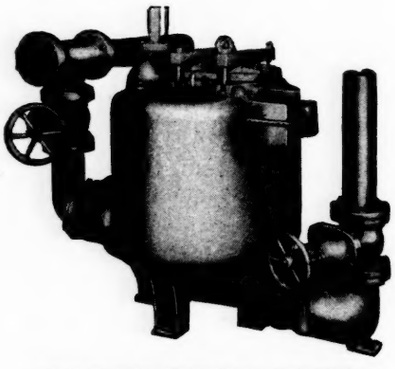

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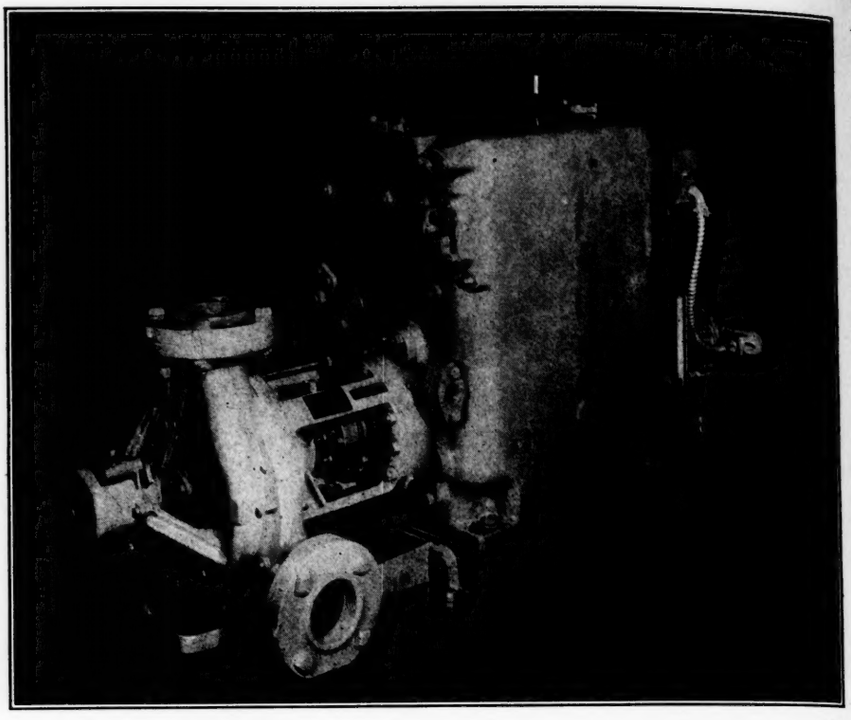

Jennings Vapor Turbine Heating Pump. Operates directly from system steam without electric current. Constant operation assures uniform system operation. Steam used for operation is returned to system for heating with little heat loss. Eliminates current cost and effects material steam economy. Ask for Bulletin 246-A.

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Traffic intersection and garage during construction before railroad tracks had been completely covered.

Ventilating A Large Underground Garage

By JOSEPH F. KERN†

AT the present time the City of New York has under construction an express highway which will connect, through the Hendrick Hudson Drive, the parkways of Westchester County with Canal Street in downtown Manhattan. The highway, which will be approximately 13 miles long, runs along the eastern shore of the Hudson River and in certain sections is built over the tracks of the New York Central Railroad. A number of sections of the highway are now open to traffic and others are being put into operation from time to time. It is expected that the entire highway will be open by early fall.

The latest section to be completed, that which extends from 72nd to 79th Streets, has incorporated with it an unusual combined traffic intersection, garage, restaurant, and sunken plaza. This intersection is at 79th Street and is a combination of a four-leaf clover intersection and a traffic circle. Beneath the traffic circle is a restaurant and sunken plaza and beneath this is a 200-car garage.

Motorists who wish to stop at the restaurant or in the new Riverside Park, which is now under construction, will be able to park their cars in the underground garage. The garage is reached by two inclined driveways branching off the traffic circle on the river side. It occupies the entire area beneath the traffic circle and is entirely underground except for one small wall on the river side. It is constructed of reinforced concrete and cut stone.

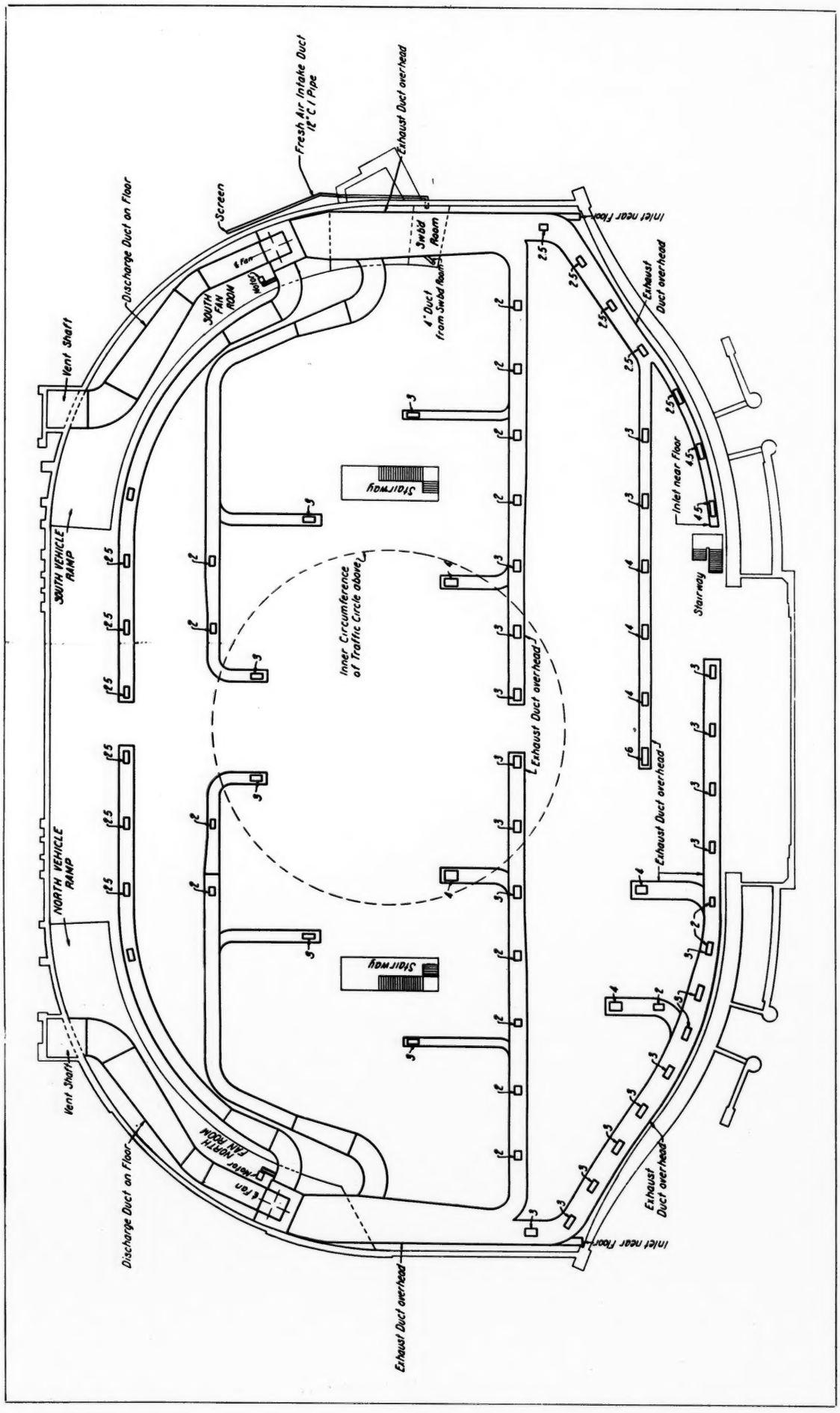
Since the garage has only four openings to the outdoors—two at the entrance of the inclined driveways and two other openings in the river wall—it was necessary to provide a complete exhaust system. Outside air is brought in through the four openings and is exhausted from the garage by two large fans which force the exhausted air through two large masonry flues discharging above the road level. The main purpose in ventilating the garage is to keep the concentration of poisonous gases down to safe limits.

Analysis of exhaust gases from motor vehicles shows that the principal gases given off are carbon dioxide, oxygen, carbon monoxide, hydrogen, methane and nitrogen. The most important of these in respect to ventilation is carbon monoxide, which is a highly poisonous gas and injurious to health when small quantities are breathed for a long time. Gasoline engines in summer or when cold may also throw off disagreeable vapors which are irritating to the eyes and nauseating to some persons.

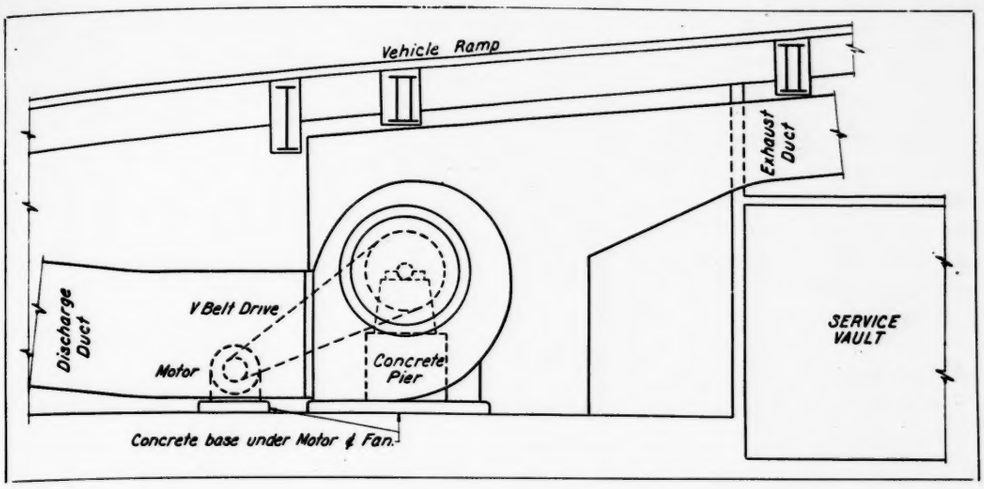
TABLE 1.
CARBON DIOXIDE FROM PASSENGER CARS
(Cubic Feet per Minute per Car)

Speed M.P.H.	Up Grade	Down Grade	Level
10.....	1.40	0.648	1.02
15.....	1.99	0.962	1.44
Accel. from rest ..	1.83		1.65
Engine idling....		0.734	
Engine racing....		1.393	

†Assistant Editor, HEATING & VENTILATING.



Layout of ducts in garage under 79th Street traffic circle. Numbers refer to amounts of air removed by each exhaust opening in thousands of cubic feet per minute.



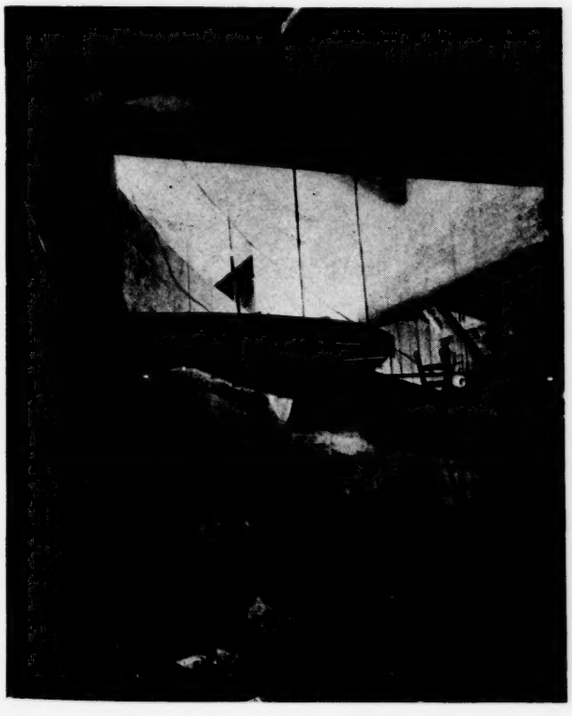
One of the fan rooms underneath vehicle ramps. Fan motor is located outside of fan enclosure.

Tests conducted at the Bureau of Mines Experiment Station at Pittsburgh, Pa., indicate that an average automobile will produce carbon monoxide in quantities as shown in Table 1.

In designing the ventilating system for any enclosed space where the gases from gasoline engines are present, sufficient outside air must be provided to dilute the carbon monoxide concentration down to at least four parts of carbon monoxide to 10,000 parts of air. This concentration of gas is usually low enough so that it will not have any physiological effect on human beings exposed for short periods. To obtain proper dilution some designers allow a theoretical volume of 5000 c.f.m. of outside air for each idling car. However, this amount can be reduced when the outside air is effectively utilized.

In this garage the engineers have provided two separate exhaust systems, each capable of exhausting 100,000 c.f.m. The exhaust ducts are so arranged that they withdraw air from the entire structure leaving no dead spots. In practically all cases the exhaust outlets are located near the ceiling although in a few instances there is a grille near the floor. Exhaust ducts are made of galvanized iron and are hung from the ceiling. In each system there are four main ducts which carry the air into an enclosure constructed around each fan. This plenum chamber is constructed of galvanized sheet steel of 10 gage supported on a structural steel frame. It is so built that the side and back and the connecting ducts may be readily removed to permit repairs or replacements of the fan or motor. An opening approximately 8 x 24 in. is provided to ventilate the fan room.

The fans used are of the centrifugal type and have a capacity of 100,000 c.f.m. against a total static pressure of 2 in. of water when the motor is operating at full speed. They are of the multi-blade, non-overload or limit load type, double inlet, bottom horizontal discharge, designed for operating at moderate speed. Each is driven through an extended shaft and a multiple



(Left) Exhaust duct in garage at the point where it enters fan room. Note long hangers supporting duct. (Below) A general view of the garage showing ramp. High ceiling makes necessary the use of extremely long hangers to support the ducts.

V-belt drive by a variable speed electric motor. Motors are equipped with a slide base to permit necessary adjustment. The fan proportions have been so selected that when the fan is delivering the rated quantity of air the inlet velocity does not exceed 2000 f.p.m. and the outlet velocity 2300 f.p.m.

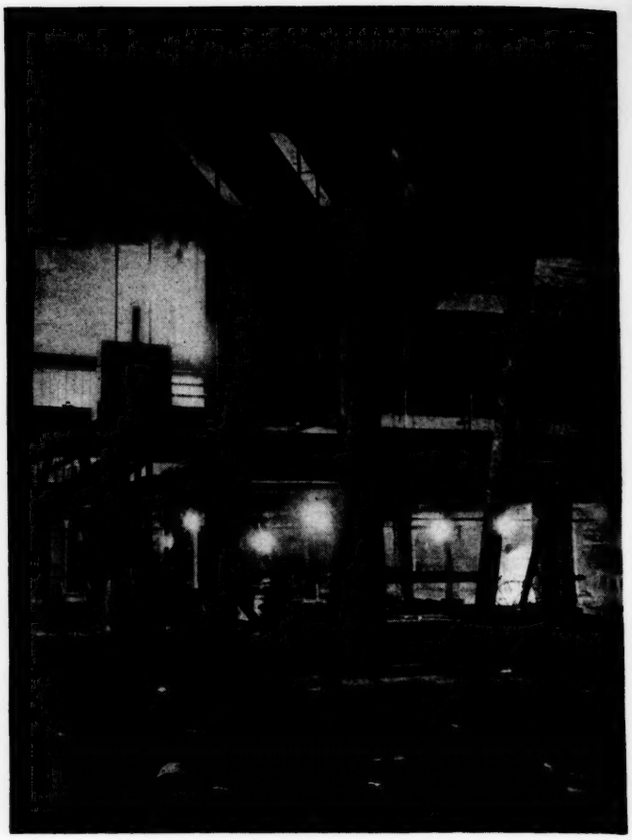
The exhaust inlets to ducts are of sufficient size so that air enters at an average velocity not exceeding 500 f.p.m. Each is equipped with a damper for adjusting the amount of air admitted and the inlet opening is covered with galvanized wire netting set in a removable steel frame.

Air leaving the fan is carried through a discharge duct on the floor of the enclosure beneath the vehicle ramps to a vent shaft. This shaft is made of concrete and discharges the air to the outdoors above the upper roadway.

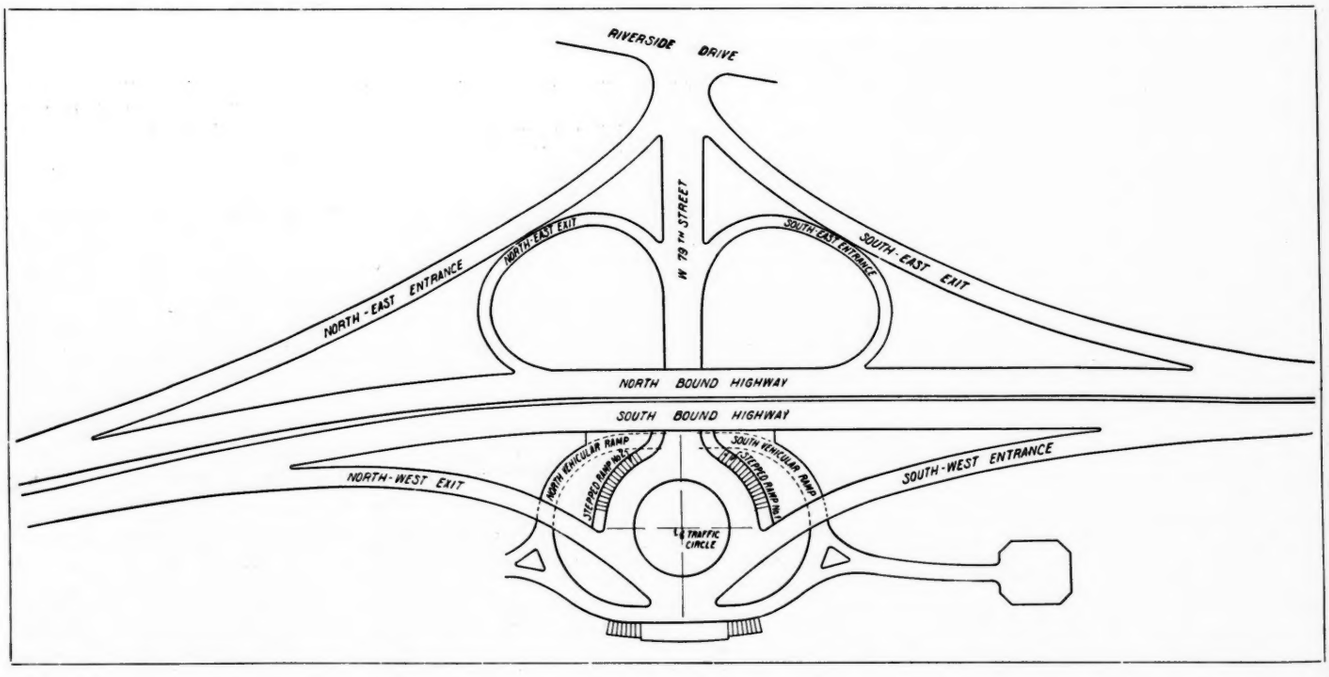
The switchboard room located near the south motor room is provided with a fresh air inlet and duct. This duct is constructed of 4-in. cast iron bell and spigot pipe with joints sealed with lead. The discharge end in the switchboard room is equipped with a damper with a suitable locking device.

To prevent the condensation of moisture on the switches during cold weather, electrically-operated unit heaters of the blower type are provided in the switchboard room. Two units, each having a rating of 3 kw., are used. The units can either be controlled automatically or manually.

Two gas-fired heaters are provided, one for heating the men's toilet and one for the women's toilet. These heaters have an input rating of 100,000 B.t.u. per hr. and an air delivery of approximately 2100 c.f.m. The unit heaters are provided with adjustable louvers on a discharge face and have a vent to the outside air. Operation of the heaters is controlled by a room thermostat which makes it possible to regulate the temperature between 50 and 75F. A motor-driven exhaust blower with a capacity of 125 c.f.m. is provided for each unit heater. This exhaust blower forces the gases through an exhaust duct to the outside air. Two gas-fired water heaters for providing domestic hot water have also been installed.



Interior of garage during construction. One of the exhaust ducts can be seen in the center of the photograph.



Plan of combined clover leaf intersection and traffic circle at 79th Street and West Side Express Highway. Garage occupies entire area beneath traffic circle and vehicular ramps.

Evaporative Condensers for Cooling Water for Air Conditioning

SUPPLY and disposal of cooling water for refrigerating equipment is a problem which has occupied the attention of engineers for a number of years. The recent increase in the use of air conditioning with its attendant demands for water has resulted in the necessity of developing apparatus for conserving water supply and reducing water discharge into sewers. One of the most important contributions to the solution of this problem which has appeared to date is the evaporative condenser.

An excellent discussion of the use of this type of equipment for air conditioning and refrigeration was recently published by the Ebasco Services Incorporated in a special engineering letter to its client utility companies. It is a private report and is not available for general distribution. Lack of space makes it impossible to present a complete outline of the information included but it is possible to present abstracts of some of the more interesting and important material.

These abstracts follow:

Advantages of Evaporative Condensers

Principal advantages claimed for evaporative condensers include the following:

Compared with direct (once-thru) use of cooling water:

(1) Saving of 90 to 95% of water consumed.

(2) Freedom from complete service interruption, in the event of emergency failure of water supply.

(3) Avoidance of load curtailment or shutdown, resulting from shortage of municipal or private water supply in protracted hot weather.

(4a) Elimination of need for enlargement of service connection from city mains, when air conditioning or refrigeration is installed in existing buildings.

(4b) Elimination of private well and pumping unit, together with disposal well demanded in many localities.

(5) Contribution toward solution of water-supply and sewage-disposal problems facing many municipalities.

For specific applications, the evaluation of initial investment and annual operating expense should take into account the mentioned factors and any other considerations involved.

Power Requirements

Motor loads represented by evaporative condensers range about as shown in Table 1. Ratings are based on maximum hot weather requirements for air conditioning service. In several cases, pumps for small size units are operated from fan drives, eliminating separate motors.

It is customary to utilize full capacity of condenser fans and pumps, even in moderate or cool weather. Saving in power consumed by compressor motor because of the slight reduction in condensing temperature and pressure obtained by using full quantity of air and spray water, offsets in large measure any reduction in power obtainable by limiting the outputs of fan and pump. There is also the advantage of greater simplicity through elimination of pump and fan controls. Energy consumption of condenser motors therefore is based on operation during the same time intervals as the compressor served. An exception is in the case of refrigeration equipment operated in winter, when spray system may be shut off to prevent freezing.

TABLE 1—EVAPORATIVE CONDENSER MOTOR SIZES

Capacity		Pump, Hp.	Fan, Hp.	
B.t.u. Hr.	Tons		Without Ducts	With Ducts
60,000	5	1/6 to 1/4	1/2 to 1	1 to 1 1/2
240,000	20	1/6 to 1/2	1 1/2 to 3	3 to 5
600,000	50	3/4 to 1	10 to 15	10 to 15

The evaporative condenser has been developed to decrease the water used by air conditioning and refrigerating systems. These devices condense the hot refrigerant gases by passing them through coils which are cooled by the evaporation of water. This article discusses the evaporative condenser from the standpoint of advantages, power requirements, storage requirements, selection of size, summer and winter operation and maintenance.

Installation Requirements

As bearing on total investment involved, there are outlined below the principal considerations affecting installation of evaporative condensers.

If located outdoors, unit should be placed so that prevailing wind blows toward inlet and assists in dissipating the discharge air; openings for intake and discharge should be specified on opposite sides of housing. Where location, determined by other factors, results in "pocketing" of condenser by adjacent walls, ducts should be provided for taking air from area having unobstructed circulation. Moist discharge air should be kept away from nearby windows or doors.

If located indoors, position should be chosen with a view to shortness and easy connection of intake and discharge ducts. Inlet and outlet openings should be well separated to prevent recirculation, which would seriously reduce the condenser capacity. Adequate clearances should be provided for access to removable housing panels, inspection doors, motors, bearings, belts, pump and external piping. Especially in basements, there should be sufficient height to insure drainage from overflow and washout connections of water tank. Usually, casing is so constructed as to permit reversing positions of doors, piping connections and air discharge, in case these have not been suitably specified before shipment; 90° rotation of end bells of fan motor may be necessary, if discharge openings of fans are shifted from side to top.

Air supply may be under some conditions drawn directly from the machine rooms or other parts of building, thereby ventilating them without use of separate fans. If this is done, provision must be made for introducing an equal amount of air to replace that withdrawn. In other cases, it may in winter prove advantageous to utilize a part or all of the discharge air for humidification, but supplementary heat from another source is then necessary to prevent excessive humidity, since air leaves the condenser nearly saturated.

When condenser is at approximately the same level as evaporators receiving refrigerant from it, no allowance need be made for pressure drop in suction and liquid lines, or in rated capacity of expansion valves. However, if condenser is above the evaporators, static head in liquid line produces increased pressure differential at expansion valves, and the latter should have ports of reduced size, selecting these in accordance with manufacturers' rating tables. When evaporators are above an evaporative condenser, pressure exerted on liquid refrigerant decreases as it flows toward expansion valve; this for Freon is at the rate of 0.55 lb. per sq. in. per ft. of rise, and unless sufficient subcooling of liquid is provided by evaporative condenser, part of the liquid will flash into vapor before passing through the valve ports into evaporator. This action imposes a limit on practicable height of evaporator units above condenser, since flash produces erratic operation, reduced capacity of valve and other effects which are objectionable.

Wiring connections should place condenser fan motor in parallel with compressor motor so that condenser and compressor will always operate simultaneously. Pump motor and inlet water solenoid valve are in turn wired in parallel with fan motor. Thermal overload protection should be provided for all motors.

Refrigerant piping for compressors located in basement or at any level considerably below condenser should have a loop in hot gas line to prevent backing up of oil and condensed refrigerant on compressor cylinder head. Refrigerant connections on unit should not be opened until immediately before piping work is commenced, and other precautions should be taken to prevent moisture entering the system.

Water supply connected to float control in water tank should have a bypass around the pressure regulating and solenoid valves, permitting operation while this control assembly is being serviced. Waste connection to a suitable drain should be provided from overflow outlet in tank. It should be understood that continuous slight discharge from overflow is necessary, in order to prevent formation of scale on the finned surfaces, as result of accumulations built up by natural hardness in the water or solid deposited by the air.

Duct connections from indoor installations should be carefully designed, with due regard to permissible velocity, frictional resistance and noise. Pressure losses should be closely estimated in advance of ordering the condenser, so that fans of proper characteristics and speed, and motor of adequate rating, may be specified to and furnished by equipment manufacturer; in some cases, motors of size larger than standard will be needed, increasing the price somewhat.

Multiple Installations and Two-Circuit Condensers

Owing to the difficulty of securing pressure balance, refrigerant and lubricating oil distribution, and liquid level control, it is undesirable to interconnect evaporative condensers. With installations large enough to require multiple compressors and condensers, means can usually be found to divide evaporator coils into distinct circuits and to provide one compressor and one condenser for each circuit. If multiple connecting is unavoidable, certain precautions as to choice of equipment and method of making connections should be observed; advice from manufacturer should be secured before equipment is specified or installation started.

Adoption of two-circuit evaporator design is an economical and satisfactory way of avoiding multiple compressor connections. The two-circuit assembly forms two complete systems of condensing coil, receiver and sub-cooling coil within a single evaporative condenser. Each circuit is connected to its own compressor, and these may operate at different suction pressures. Wiring connections should, however, be made so that motors driving condenser fans and pump will run as long as compressor on either circuit is in service. It is even possible to use multiple compressors and evaporators with one or both circuits in a two-circuit evaporative condenser, although this is not recommended, for reasons mentioned in preceding paragraph.

Two-circuit units are generally constructed by dividing the total condensing coil surface into two sections, one above the other. When condensing temperatures are the same in both, upper coil has about 40% of the total capacity and lower coil 60%. Consequently, the larger compressor load should be connected to bottom coil. When the two systems have loads with ratio other than 40:60, the larger load must be served by bottom coil, and condensing temperatures will not be the same in both coils.

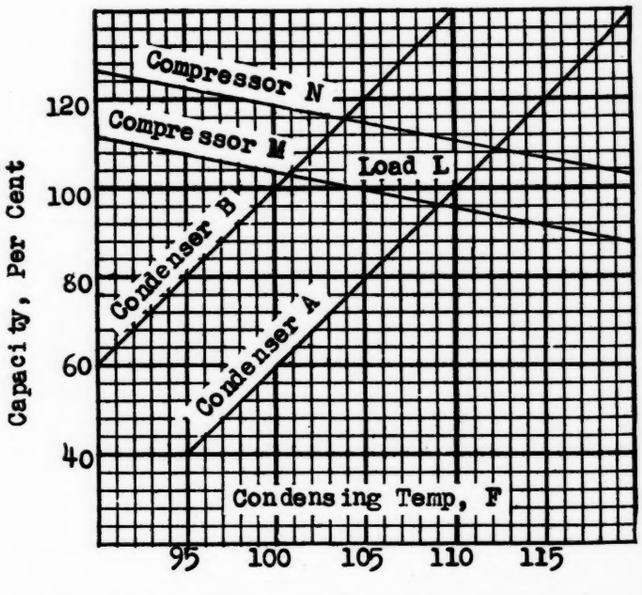


Diagram for selecting correct size of evaporative condenser and refrigerating compressor.

Section of Condenser Size

For approximating the size of evaporative condenser needed, to serve a given B.t.u. per hr. load at the selected maximum wet bulb temperature appropriate to the locality, use may be made of rating curves for the various models offered by equipment manufacturers. However, it is first necessary to make an assumption as to condensing temperature, and this may be taken somewhere between 20 and 35F above maximum wet bulb. Value used will depend on relative importance attached to obtaining low investment cost and to minimizing the annual operating expense; it should include whatever allowance is considered necessary, for providing against future impairment of heat transfer as result of scale accumulations or advancing age. Low condensing temperature makes for economical operation, because power input to compressor is reduced, but it requires a liberal size evaporative condenser. Effect on compressor size and investment must also be taken into account, in case the installation involves a new compressor.

Combinations of condenser and compressor size that should receive consideration are indicated by accompanying diagram, Fig. 1, which shows for a given load, L, the influence of condensing temperature on equipment capacity. Curves A and B apply to successive sizes of condenser, while M and N are for two sizes of compressor—all based on the particular conditions adopted for the installation in hand, such as 80F wet bulb and 40F compressor suction temperature. Intersections of the curves give capacities for the four possible equipment combinations. Point AM is below the load requirement, eliminating the combination of smallest compressor and smallest condenser. Point BN gives the highest capacity, but investment is also highest. Points BM and AN both satisfy the load requirement and give intermediate equipment cost. The combination of large condenser B and small compressor M yields lower condensing temperature and compressor power requirement than small condenser A and large compressor N; however, the greater auxiliary power for the larger condenser in part offsets its advantage of lower compressor load. To permit an intelligent choice of equipment it is therefore necessary to prepare the usual form of cost analysis, which compares investment, fixed charges, operating cost and available capacities, for the three combinations.

Notes on Operation and Maintenance

As indicating magnitude of annual expenditure for operation and maintenance, which must be estimated for determining savings obtainable, there are listed below the usual service requirements of evaporative condensers:

Eliminator plates should be inspected and any dirt or scale accumulations brushed off; surfaces should be painted when necessary to prevent corrosion.

Spray nozzles should be cleaned, if clogged or subject to incrustation.

Water receiving tank should be cleaned regularly and painted when necessary to prevent corrosion; strainers in pump suction and water supply line require regular cleaning; water regulating valve requires adjustment to give correct outlet pressure; float valve should be set to maintain slight continuous overflow for sealing pump suction, removing dirt and preventing accumulations of dissolved solids in spray system.

Finned coil surfaces should be cleaned to remove any scale deposits, by alternately raising and lowering temperature of coils until scale cracks and can then be removed by brushing, scraping, or washing; this involves starting and stopping of fans and sprays and intermittent operation of compressor.

Amount of refrigerant in system should be checked occasionally, by opening test cock on receiver.

Presence of air in refrigerant lines should be determined, by comparing stabilized system pressure and temperature after an overnight shutdown; any air accumulation should be removed by purging.

Lubrication of fan shaft and motor bearings should be checked, likewise tension and condition of belt drives, alignment of dampers and linkage.

Electrical equipment inspection should cover motor starting switches, fuses, overload and excess pressure relays, solenoid water valves, etc.

Many of the items listed above are equivalent to those involved with shell-and-tube condensers and cooling towers. Owing to greater compactness of the evaporative condenser, it may reasonably be expected that overall annual operating labor and maintenance costs will prove no greater, and usually less, than for the alternative equipment

Winter Operation

If system is required to operate when outdoor temperature drops below freezing, the evaporative condenser should preferably be placed indoors. In case outdoor location is unavoidable, entire water pumping and control system must be divorced from condenser and located in a heated space; consequently, unit should be ordered with pump and discharge pipe omitted. It is then necessary to install a separate sump tank indoors, into which the condenser spray tank drains continuously. This sump tank requires a float control adjusted to maintain continuous slight overflow during operation; solenoid valve in water supply line will act to prevent wastage during shutdown periods. A pump of suitable head characteristics and capacity must be provided to circulate water from sump tank to spray nozzles or flooding pipes, inasmuch as condenser manufacturers' standard pumps are of low-pressure type and cannot be used.

For installations employing either Freon or methyl chloride, there should be included an air intake damper box with automatic pressure type damper motor. Latter is connected to refrigerant receiver discharge valve and operates to close intake damper whenever condensing pressure drops below the desired minimum. This assures benefits of low condensing temperature and low operating cost during cool weather, at the same time protecting against failure to operate as result of extremely low air temperature entering unit and producing a condensing pressure so low that the liquid will not flow. When unit shuts down, the damper automatically closes as the condensing pressure drops and thus prevents circulation of cold air through the unit.

PICTURE PARAGRAPHS

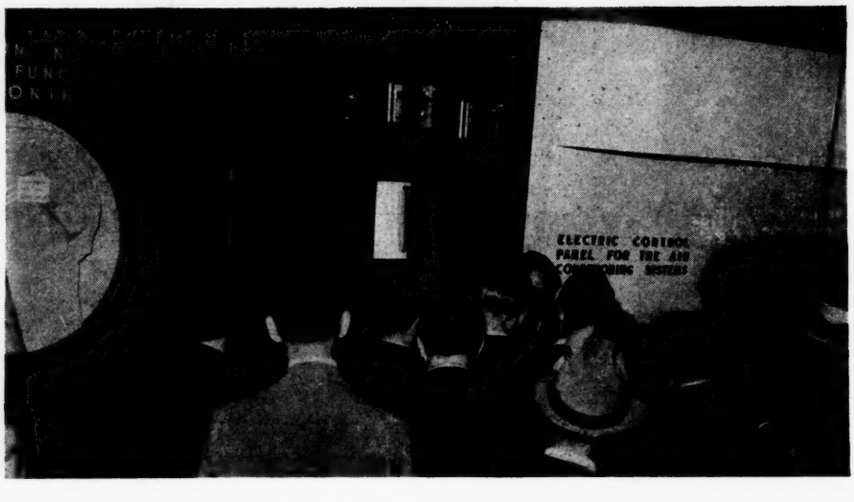
Charles K. Foster, executive vice-president, and M. J. Beirn, vice-president and general manager of sales of American Radiator and Standard Sanitary Corporation, at the opening of the combined showrooms.

Charles Rosenkranz, wholesaler; J. J. Hall, vice-president and general manager of sales of Standard Sanitary; William Brecht, Hajoca Corporation; Charles K. Foster, executive vice-president; and Arthur R. Herske, vice-president and general manager of sales of American Radiator Company.

The black and gold American Radiator Building at 40 West 40th St., New York, with the new annex shown at the right.

In a two-day celebration attended by more than 3000 persons, 14 companies of the American Radiator and Standard Sanitary Corporation opened the largest showroom in the building industry in a six-story annex to the company's black and gold tower at 40 West 40th St., New York. The space devoted to heating, air conditioning and plumbing display totals nearly 30,000 sq. ft. The showrooms were designed by Skidmore and Owings, industrial designers, under the direction of Dr. Charles W. Brabbee. All of the showrooms are completely conditioned for both summer and winter, using steam jet cooling in the summer. On these pages appear seven photographs taken at the opening.

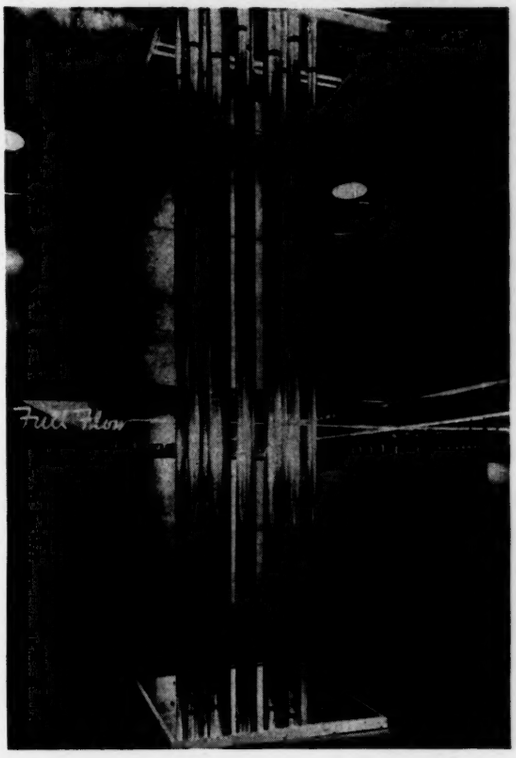
Dr. Charles W. Brabbee (Above), under whose direction the new showrooms were constructed, standing beside one of the biological exhibits that he developed.



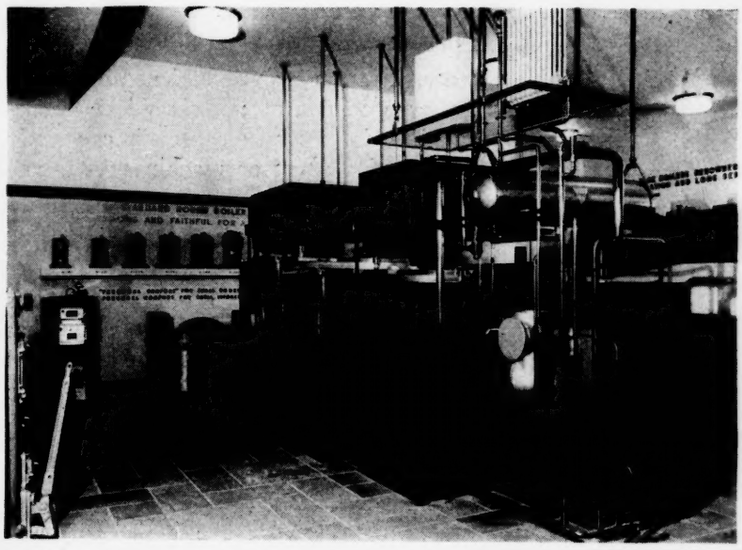
(Left) Crowd around one of the biological displays at the opening of the showrooms.

Henry B. Gombers, now 81 years of age, made his first airplane flight returning from the Heating, Piping and Air Conditioning Contractors National Association convention at Minneapolis. He is shown here boarding the United Air Lines plane at Chicago. Mr. Gombers, secretary emeritus of the Association, was secretary for 40 years

The pipe crew on a $200,000 piping and air conditioning job. These men are installing the piping in the $2½ million Owens-Illinois building at Oakland, Calif. The crew, totalling 157 men, will be at work until September. They are employed by Robert D. Fearey, Oakland heating and piping contractor.



The copper room in American Radiator's showrooms. The walls and ceiling are covered in sheet copper, with mirrors at the floor and ceiling to simulate endless miles of copper pipe.



(Above) The oil burning boiler section in American Radiator's showrooms. A line of round boilers in miniature is shown in the background.

Sixty tons of tunnel fans. (Right) Six of 36 Buffalo Forge ventilating fans for the new Lincoln Vehicular Tunnel under the Hudson River in New York. There will be 17 supply fans and 19 exhaust fans handling a total of almost 3¼ million c.f.m. Capacity of these 36 fans would be sufficient to supply and exhaust air for 10 million people.

Steam Traps and Their Characteristics

1.—What Traps Do and How Thermostatic Traps Work

By T. NAPIER ADLAM†

The steam trap is a very useful, and even essential, device. In this series Mr. Adlam gives his thoughts on the operating principles and characteristics of many kinds of steam traps, together with some examples of how to estimate the amount of condensate which traps must handle when connected to a few typical steam-using devices. In this article he explains how thermostatic traps work—a point regarding which there is, as he says, a surprising lack of knowledge among trap users.

THE use of steam for the purpose of heating and industrial process work results in the abstraction of the latent heat and the formation of water practically at the same temperature as the steam from which it is derived. In order that the highest efficiency should be maintained in any steam heated equipment, it is essential that this condensation be removed with no loss of steam.

The appliance which performs this important function is known as a steam trap, and it is of historical interest to know that steam traps have been in use for over eighty years. The earliest record of an inverted bucket trap appears to be in 1874 when a patent was taken out in England for a box type trap with an inverted bucket.

In some instances it is necessary that the condensate be removed immediately it is formed, regardless of its high temperature; whereas for many other uses a greater thermal efficiency can be obtained by allowing the condensate to remain in the radiator, heater, or other apparatus until it has given up an appreciable amount of its sensible heat. This results in a saving of steam and a consequent lower condensate discharge temperature.

While it is more or less obvious that any one of the many types of steam traps in general use may work for a time under given set conditions, it is too often found that due consideration is not given to the selection of a trap to insure that the one chosen is the best type for the particular work it has to perform. By careful analysis and experience it has been found that some types have such inherent faults that they are always wasteful; some have small passages or seats which will very quickly choke or require constant attention; some have oscillating parts which quickly wear, so that they either cease to function or allow steam to pass; others may be satisfactory for one pressure and load but give trouble as soon as the pressure or load varies.

A careful study of steam trap design and the various characteristics is the only basis on which the correct selection of a trap as an item of operating equipment should be made. Lack of knowledge in steam trap design usually means that a steam trap is bought on a price basis, with the result that it turns out to be a troublesome and costly item in many steam plants and industries. This, undoubtedly, is the reason a steam trap is often looked upon as a necessary evil, for certainly if a trap is not selected because of its special feature to deal with the particular job it always will remain an expensive source of trouble.

A steam trap can be one of the most wasteful units in the whole plant, or it may be a most efficient and ever-watchful guard against waste of steam and speed up the output of any machine to which it is connected. In addition to collecting the condensate and discharging it without allowing steam to pass, a steam trap must, to be efficient, be capable of passing all air and other incondensable gases as soon as they reach the trap because air in any kind of steam heated apparatus will retard the flow of condensate to the trip; it will create cold spots in the machine or heater and reduce the output of the equipment, whatever it is, to an unbelievable extent. A steam trap should not be merely a fitting to discharge condensate; it should be an efficiency unit, and if it is correctly chosen it can easily increase the output of a plant or machine 100% and still save steam.

Design and Capacity

Frequently, the actual maximum duty required is unknown, so that more often than not a selection has to be made on the basis of individual judgment and previous experience of similar conditions, allowing a generous factor of safety.

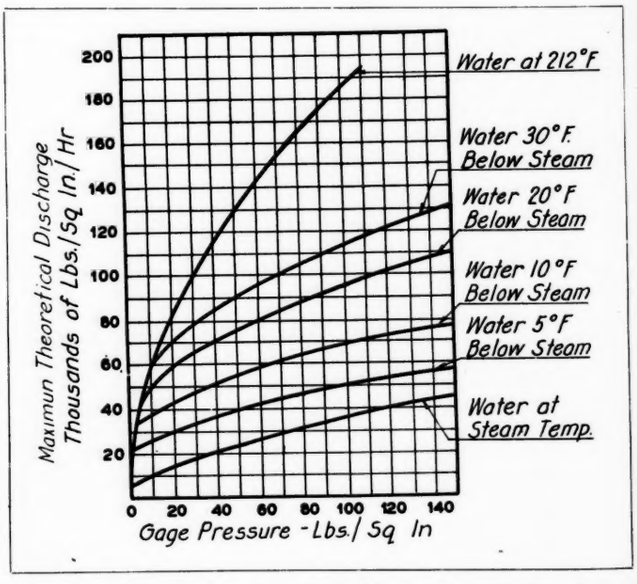
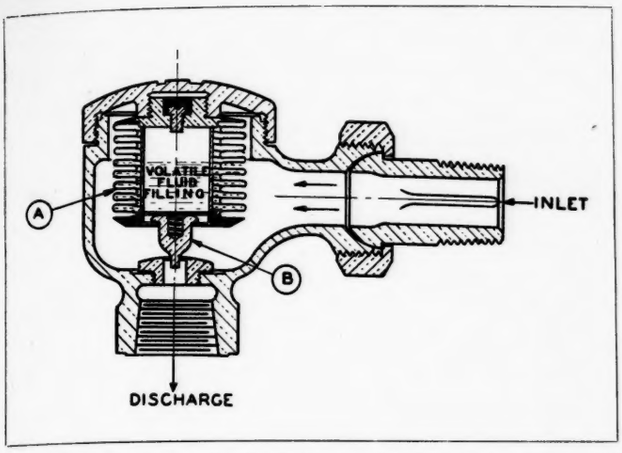


Fig. 1. Theoretical rates of discharge when hot water at various temperatures and pressures flows to the atmosphere.

†Chief Engineer, Sarco Co., Inc.



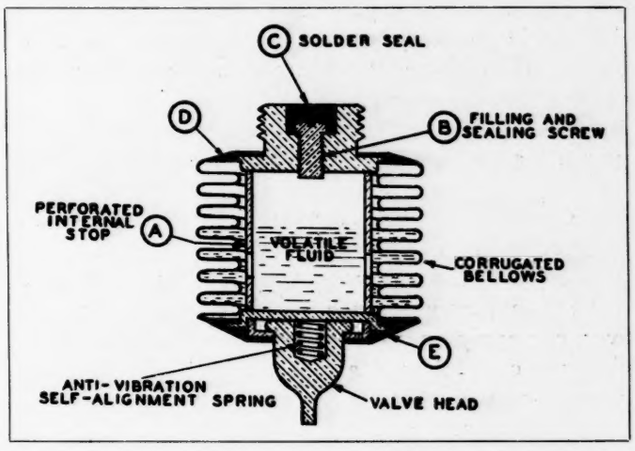


Fig. 2. (Left) Cross-section of thermostatic trap. Fig. 3. (Right) Thermostatic trap bellows using volatile fluid.

This may be said to be particularly true of traps installed to drain steam mains and separators where the initial condensation and the wetness of the steam are unknown quantities; even with many machines and boiling equipment the actual peak loads are often problematical, but when dealing with heaters, evaporators, and similar equipment designed to deal with definite rates of condensate at a specified pressure, it is imperative to know exactly the trap capacity.

Without going into the many technical factors controlling the discharge of hot water from steam traps, the curves shown on Fig. 1 should be carefully studied as they give a broad view of how much the capacity can vary depending upon the temperature of the condensate.

When publishing trap capacities, it is customary for trap manufacturers to base their figures on the actual pressure differential across the trap, or in other words, the difference between the pressure on the inlet of the trap and that at the discharge. This method of tabulating capacities is sound engineering but the pressure at the inlet to a trap should not be confused with the initial pressure in the steam supply main, as much depends on the drop in steam pressure through the heater.

There are some very important details in a trap which affect the capacity considerably. For instance, the capacity of a trap may depend upon the shape of the valve head and seat, also on the construction and roughness of the passageways; while with thermostatic traps the nature and construction of the element may greatly affect the capacity. Consequently, it is not safe to decide on a trap by the size of the trap body, the size of the pipe connections, or even the size of the discharge orifice. The inlet and outlet pipe sizes are stated for the user's information but the essential features are inherent in the internal construction of the trap; hence, a good knowledge of trap characteristics is necessary before making a choice.

A steam trap, as we have already seen, may be just an appliance for collecting condensate from the steam and automatically discharging it, with all incondensable gases, into a tank, hot well or other receiver, but the efficiency and output of the machine drained will depend entirely upon whether the correct make and design of trap has been chosen.

There are many different types of steam traps on the market but the following list includes those having notable differences in construction and operation: (a) thermostatic; (b) float and thermostatic; (c) inverted bucket; (d) open top bucket; (e) liquid expansion; (f) restricted orifice; (g) impulse; (h) metal expansion and bimetallic.

Thermostatic Traps

A typical low pressure thermostatic trap is illustrated in Fig. 2 and is constructed with a motor element A which automatically opens the valve B to allow condensate to pass and closes same to prevent steam escaping.

The element, a sectional view of which is shown in Fig. 3, is partly filled with a volatile fluid having a boiling point a few degrees lower than that of water, and it is important that this pressure-temperature differential shall remain fairly constant throughout the normal working pressure and temperature range of the trap. The closer the relation between the pressure and temperature curve of the filling to that of the water, the more satisfactory will the trap function as the steam pressure varies.

The chart, Fig. 4, illustrates the pressure-temperature characteristic of various liquids compared with that of water, and from a careful study of this chart it will be seen that when the motor element of a trap filled with a liquid corresponding to, say curve X, reaches a temperature of 230F, it has an internal pressure of 10 lb., whereas with a liquid filling corresponding with curve Y it has an internal pressure of 10 lb. when only 220F.

This means that when a thermostatic trap fitted with an element which has been charged with fluid X is working with steam at 10 lb. pressure and the condensate collecting in the body of the trap reaches a temperature of 230F, the element will have an internal pressure also of 10 lb., or a pressure which balances that of the steam. Now, any slight increase above 230F in the temperature of the condensate reaching the trap will immediately produce an extra pressure inside the element, causing the bellows to expand and, when the temperature is raised sufficiently high, will create enough internal pressure to close off the trap entirely.

In a similar manner an element filled with fluid Y

will have a balanced pressure of 10 lb. when the condensate in the trap reaches a temperature of 220F, closing off the trap at a temperature 10F lower than the one filled with fluid X.

It is easy to see, therefore, that for any given steam pressure a suitable filling can be chosen which will operate the trap at any desired condensate temperature, while a study of the curves in Fig. 4 will explain why a correctly designed thermostatic trap responds to both pressure and temperature throughout its entire specified steam pressure range. This characteristic, however, can apply only to correctly designed thermostatic elements charged with a liquid having a proportional pressure-temperature curve.

On this principle, thermostatic traps are made self-adjusting for any steam pressure from sub-atmospheric up to the maximum steam pressure for which the trap is built, and in this respect, thermostatic traps are now manufactured to work efficiently from sub-atmospherical pressures as low as 25 in. Hg. up to 200 or 250 lb. gage pressure. It is not considered advisable, however, to use the same trap through this very wide range, for although a trap may be constructed to work through this range it is more economical, and better results are obtained generally by dividing the working range for thermostatic traps into say the following four stages:

(1) 25 in. Hg. to 10 or 20 lb. gage pressure.
(2) 10 in. Hg. to 65 lb. gage pressure.
(3) Zero to 125 lb. gage pressure.
(4) 50 lb. to 200 lb. or 250 lb. gage pressure.

By attempting to use traps constructed and filled exactly alike over a wide range of pressures there is a danger that the operating temperature will not follow that of steam and water.

Any deviation in the pressure-temperature relation of the filling may mean too big a drop in temperature at some pressures or insufficient margin of power to close tight when a little dirty. Dividing the range into four stages, as mentioned, provides a greater security of satisfactory working.

It is sometimes thought that the valve head of a thermostatic trap opens fully at each discharge, but under most working conditions this is not the case. A thermostatic trap may give the same efficiency when operating with intermittent discharges as when discharging at a more or less constant rate; i.e., with the condensate steadily trickling past a slightly open valve head, although this action continued is apt to cut away the metal of the valve head and seat if these parts are not made of good quality material. The exact way in which a thermostatic trap will function depends largely on the rate and temperature at which the condensate enters the trap, so that as long as a trap performs its work efficiently, the actual method of discharging is found in many cases to be relatively unimportant except when draining a delicate, automatically controlled apparatus. More important is how efficiently a trap will clear away the condensate and air without wasting heat.

When choosing a trap it is always well to remember that if a fairly constant temperature is required, even though there is no automatic controlling device fitted, the results from a thermostatic trap constructed to operate fairly close to the steam temperature will give better results than one having a very low temperature of discharge, except in the case of a liquid expansion trap which, under many conditions, can be adjusted to drain at fairly low temperatures and give good temperature control at the same time.

From the curves in Fig. 4 we have already seen that an element filled with any one of the fluids there indicated will begin to expand the bellows when the condensate temperature is sufficiently high to increase the internal pressure above that surrounding the bellows and will close the trap when that internal pressure is sufficient to overcome the static pressure in the trap plus the resilience of the bellows.

Thus it is that an element functions in accordance with the relation between the pressure and temperature in the trap body, the resilience of the bellows and the boiling point of the filling. This means that while an element will expand more as the temperature of the condensate increases, it may, if the element is constructed with a bellows of good resilience, move the valve head only a very short distance from its seat, thus allowing the condensate to be discharged with very little variation in temperature. The function of the element, depending as it does on the temperature variation of the surrounding condensate for its movement, may require a drop of 10, 20 or more degrees to obtain an open position. If, then, the drop in temperature is too much, it may mean that the condensate will be held up in the apparatus too long to be compatible with the highest output efficiency of the machine; hence the need for choosing a trap with a suitable element.

As to the best operating temperature for a thermostatic trap, this is something which depends entirely on the particular equipment to be drained. When dealing with low pressure steam heating, we have already seen that if a thermostatic trap is to be used for draining a steam main it should work fairly close to steam temperature, say within 8F or 10F of the steam, otherwise there is grave risk of water being held up in the main and causing trouble. For draining cast iron radiators it is often permissible to operate 20F or 25F below steam temperature; while for draining copper or any fin type concealed heater 20F or 25F may be much

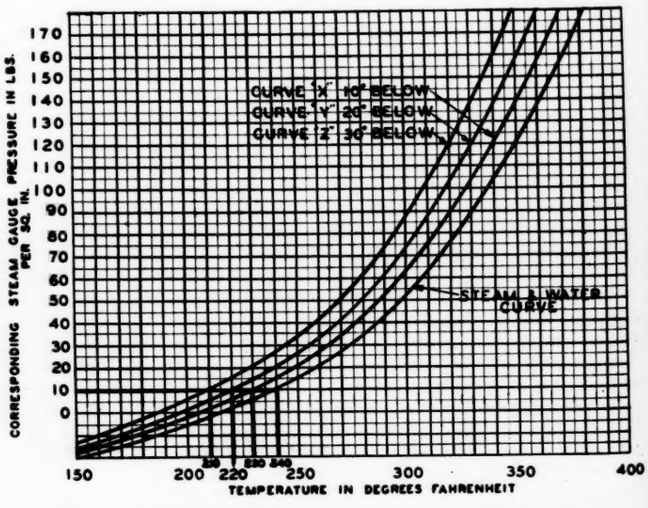


Fig. 4. Pressure-temperature curves, various volatile liquid fillers.

too low, as this would allow water to collect in the small copper pipes of the heater, causing gurgling noises or knocking, and at the same time reduce the efficiency perhaps 25% to 30%. It is a common experience with copper concealed heaters to find that when using a trap giving a low temperature discharge one third or more of the heater is water logged, allowing cold spots which not only reduce the output but actually cause cold drafts.

There is a disadvantage, however, in making a thermostatic trap work too close to steam temperature because of its tendency to reduce the closing power of the trap, with the results that should a very small amount of dirt collect on the head or seat it may prevent the head from making good contact. Small orifices and tight fitting parts will, undoubtedly, cause trouble much quicker than correctly designed and free-moving mechanisms; on the other hand, any scale or hard incrustation collecting on the seat or head of a trap or valve will certainly cause it to leak; hence the necessity for close and frequent inspection of traps when starting up a new system, and periodical examination based on experience of water and other conditions prevailing in the particular installation.

Even when a vacuum pump is installed on the return main a slight leakage from a few traps will spoil the vacuum entirely, hence the advantage of having clean traps of the correct design for the respective positions and not trying to use one type of trap for every purpose.

The lack of knowledge expressed by many engineers and trap users concerning the correct discharge temperature for a trap is somewhat surprising. Some seem to expect the same trap to clear away the condensate at high temperature when fitted to a concealed heater or steam main and to hold back the condensate until it is quite cool if fitted to some other kind of apparatus.

If a thermostatic trap is constructed to discharge the condensate at say 20F below steam temperature, satisfactory results will follow if working at 1 lb. pressure, as the condensate will then be only 195F leaving the trap. If, however, the steam pressure is raised to 7 lb. with a temperature of 233F, the condensate leaving the trap will be 213F, which immediately causes steam flashing or re-evaporation of some of the condensate into steam. This is a natural physical sequence and yet little understood by many trap users.

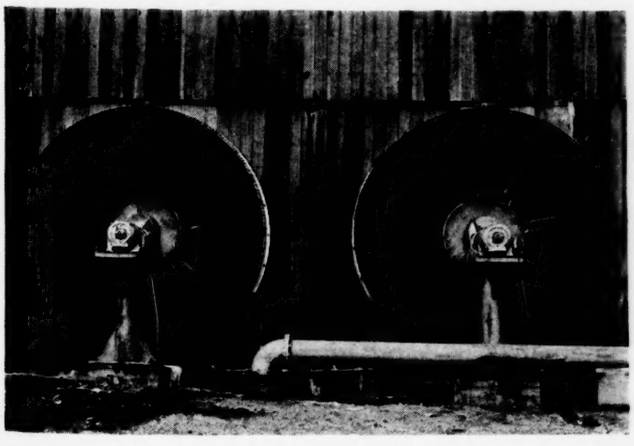
It is a practical impossibility for trap manufacturers to supply thermostatic traps to operate at an infinite number of temperatures to suit the many conditions which arise, so that a compromise has to be made to produce standard traps which will answer most purposes, and temperatures are chosen which will enable a trap to operate in a way likely to give the least trouble.

There are, of course, some conditions where the condensate can be held up in a vessel or coil until it cools to a fairly low temperature before it is discharged. Where this is possible it should be accomplished and a suitable trap chosen, for in so doing more heat is extracted from the condensate, resulting in a considerable saving of steam.

The second of Mr. Adlam's articles will deal with float and bucket traps.

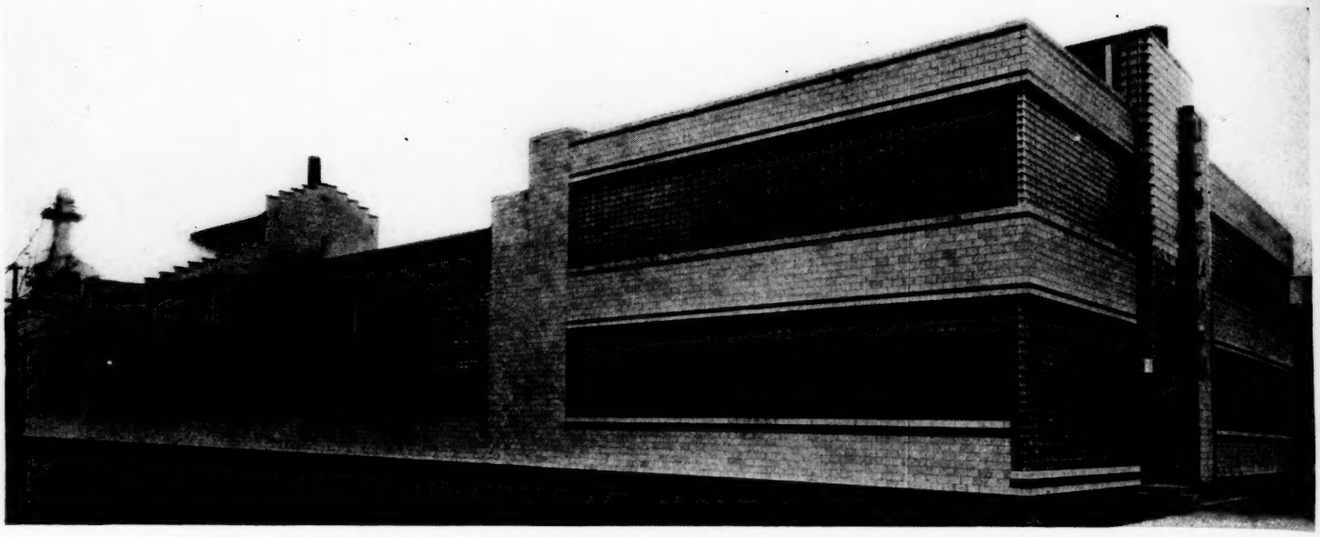
Cooling Tower Fans

A SPECIFIC example of the importance of mechanical draft in cooling towers and the simplicity with which it may be obtained was reported in a recent issue of *Heat Engineering*. The situation presented itself at the plant of a manufacturer in the mid-west. A small spray pond had been operating at the limit of its capacity when the demand for increased production took place. It was decided to supplementt the spray pond with a cooling tower, but due to the arrangement of the buildings at the plant and the fact that high temperature and calms were usual in the summer, it was stipulated that the cooling tower must function at a definite capacity regardless of weather conditions. This was made an essential since it had been found that the limitation of cooling capacity had had a serious effect upon plant operations. The new cooling equipment was to be selected upon its ability to positively carry the load quite independent of climatic conditions.



The installation chosen included four, forced draft, axial flow fans, each 12′ 0″ in diameter and mounted upon the shafts of geared motors. The fans operate at 348 R.P.M., and the motors are of 25 hp., 440 volts. At tower load each fan will deliver 147,000 cu. ft. air per minute, and the power consumption is about 21 hp. The fans are constructed of Dow metal, which is 30 per cent lighter than aluminum and 50 per cent stronger. The weight of each fan is less than 600 lb., which greatly reduces the starting loads on the motors and curtails the initial cost of electrical equipment.

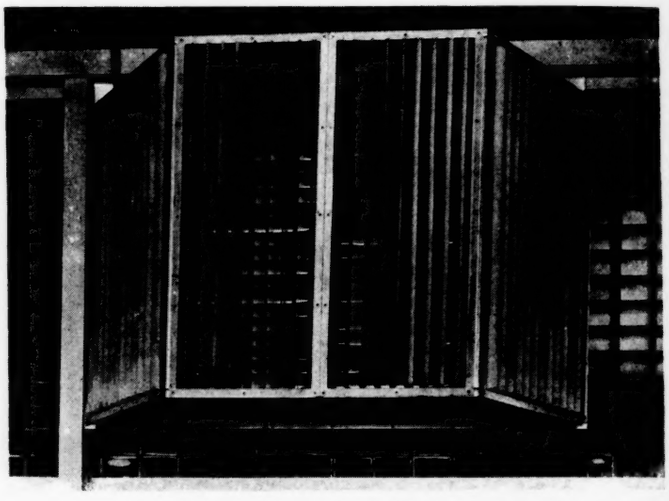
The blades of the fans may be set in three different pitch positions, thus providing minimum power consumption for operation of the tower at different seasons of the year. Remote control of the fans and automatic regulation of water temperature by thermostat makes it possible to secure any combination of fan operation necessary to effect water cooling without more than occasional inspection and oiling.



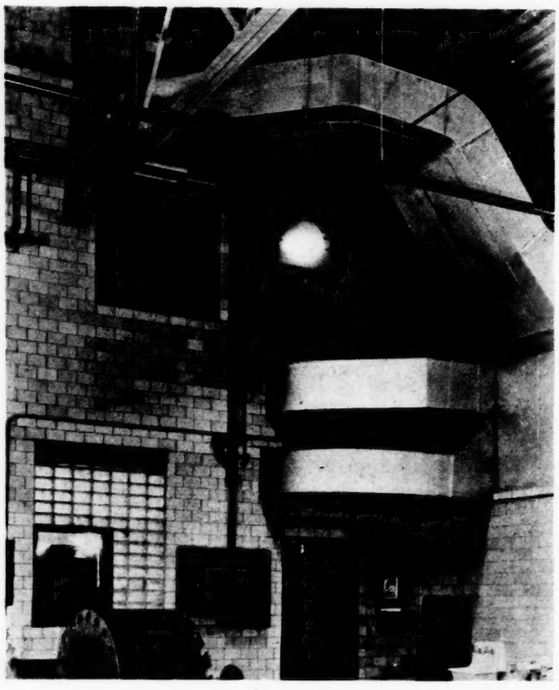
New Fiberglas laboratory of the Owens-Illinois Glass Co., Newark, Ohio

An Air Conditioned, Glass-Block Laboratory

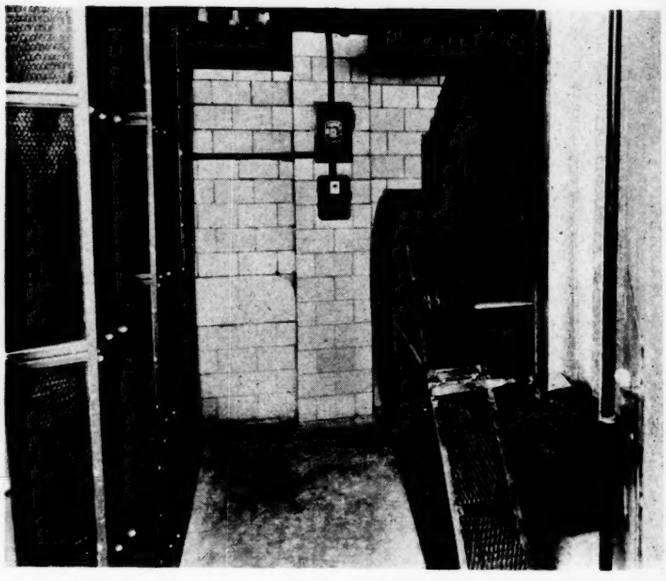
Some of the details of the new Fiberglas laboratory of Owens-Illinois Glass Company—an example of a building which, although without windows, still has the advantages of natural light.



Louver in the heating and ventilating system in the new laboratory.



Heating and ventilating ducts for the office air conditioning system.



Fan, right, and bank of Fiberglas air filters, left, in the air conditioning system of the laboratory.

Air-Conditioned Fiberglas Laboratory Built of Glass Blocks and Filters

RECENTLY completed at Newark, Ohio, a new laboratory of the Owens-Illinois Glass Company provides offices and laboratories to house research and experimental activities that are altering constructional techniques, and making glass available in new forms and for new uses.

The building is essentially an air-tight, well insulated enclosure, which requires year-round air-conditioning for maximum comfort, but at the same time, simplifies the problems of air-conditioning. Insulation and the elimination of infiltration reduces the required capacity of conditioning equipment and permits the filtering and cleaning of all air entering the building. The vacuum characteristics of the hollow blocks materially assist the air-conditioning units.

The air-conditioning system is divided into two central units, one supplying the office section and the other supplying the machine shop division. Both units are located in otherwise unoccupied spaces above the main floor in such manner that no useful floor space is occupied.

Each unit comprises a blower, drawing any required proportion of outside air and re-circulated air through filters and delivering it through conditioning chambers and distributing ducts to all rooms. The office unit supplies a number of rooms with widely varying outside exposures and consequently widely varying heating or cooling demands.

In any season, it may be necessary to add heat to one room at the same time heat is removed from the adjoining room and yet maintain a constant air change in all units. To meet this condition, the office conditioning chamber is divided into two sections, one designed to heat the air and the other to cool it. The office rooms are grouped in zones, each zone containing a number of rooms, with similar conditioning demands and each zone supplied with a separate air supply duct.

The blower discharges air through both the hot and the cold conditioning chambers and each zone duct is connected to the discharge of both chambers with mixing dampers. As the warm air damper opens, the cold air damper closes. The mixing dampers are automatically controlled with a thermostat in the key room of each zone, so that warm air, cool air, or a mixture of temperate air is delivered into each group of rooms as required, maintaining a comfortable air movement and a change of air in all rooms.

The machine shop conditioning unit supplies rooms with similar exposure, consequently no zoning controls are used and room thermostats control directly the heat supply for addition of heat and the volume of outside air intake for winter heat removal.

A distinctive feature of the machine shop conditioning is the absence of distributing ducts or pipes of any kind in the large room which might be unsightly or interfere with the placing of machinery. The discharge of proper volume of air through a single specially-designed outlet permits a uniform distribution of air without drafts.

Comfortable humidity is maintained with atomizing water sprays in each conditioning unit operated by room hygrostats. Heat is supplied to the units through extended surface copper blast coils using exhaust steam.

Summer cooling and dehumidifying is accomplished with similar blast coils through which approximately 200 gallons per minute of 60F well water is passed.

The blowers are increased in speed for summer cooling, providing a greater movement of air to compensate for a comparatively high relative humidity attained with 60F cooling water, and keeping air conditions in the building well within the comfort zone. The blowers provide a change of air in the building once every ten minutes during the winter and once every five minutes during the summer.

This system presents a simple, inexpensive and economical means of delivering a constant supply of clean, pure air to the building and maintains comfortable conditions in all rooms.

Each material in the building was selected for its utilitarian value. Ordinary methods of construction were used also and as a result, the new addition to the Newark plant is a practical example of an inexpensive modern building easily duplicated in any locality.

Development of the Fahrenheit Thermometer

ABOUT 1714 Gabriel Fahrenheit proposed to take as zero the lowest temperature obtainable with a freezing mixture of ice and salt and to divide the interval between this temperature and that of the human body into 12 degrees. Because the divisions of temperature were too large the number was increased to 96. Using such a scale with the body temperature at 96 and the lowest temperature obtainable with ice and salt as zero, the freezing point of water came out approximately at 32 and the boiling point at 212. Because it was difficult to calibrate a thermometer on the body temperature, shortly after Fahrenheit's death it was decided to use the freezing and boiling points of water as the points of calibration. When these points were determined accurately and the thermometer calibrated it was found that the body temperature was 98.6.

Illinois Sponsors Coal Utilization Course

REGISTRATION at the annual Short Course in Coal Utilization at the University of Illinois, May 25, 26, and 27 reached a total of well over 300. This continues the record of this short course which has been increasing in popularity steadily each year since its inception. Held at the same time was the 51st annual meeting of the Illinois Fuel Merchants Association which attracted an enrollment of 450.

This short course always included papers on both technical and commercial subjects of interest in the utilization of coal. This year's program was no exception. At the opening session, following an address by Dean M. L. Enger, three papers were presented, two of which were by members of the staff of the University while one, entitled "Handling the Common Heating Complaints," was by C. M. Lewis of the Kansas City Coal Service Institute. In his paper, "Smoke, Dust and Air Pollution," Prof. David R. Mitchell included among the harmful effects those resulting in harm to human beings and those which harm material objects. He pointed out that dust and smoke in the air are related to many of the respiratory diseases, including hay fever, asthma, and pneumonia, as well as a number of skin diseases and stomach troubles. According to him the annual property loss in smoky cities in the United States is estimated at from ten to twenty dollars per year per person. He doubted if any legislative action can solve the problem of air pollution unless that action is so framed that each locality can use its natural fuel. Mr. Lewis in his paper considered that in order to handle the common heating complaints it was necessary not only to have a thorough knowledge of coal and its use but also to be able to learn the cause of the complaint, the human emotions involved, and to take into account ordinary human behavior in order to handle complaints successfully.

Prof. P. E. Mohn of the University staff illustrated his talk on "Domestic Heating Plants" with numerous slides. He described the various types of domestic heating plants and mentioned their relative costs and efficiencies.

In the second session of the course three papers were presented. J. E. Martin, manager stoker division, Link-Belt Company, used as his subject "Some Sensible Stoker Sales Arguments," while J. McClintock, sales manager, stoker division, Illinois Iron and Bolt Company, spoke on "Installation and Servicing of the Small Stoker." In presenting his discussion of "Air Conditioning Equipment of Interest to the Coal Merchant" Wm. B. Hughes, manager, Automatic Coal Burning Division, American Radiator Corporation, stated that it is common practice to classify air conditioning systems under three heads; namely, 1—the split system; 2—the indirect system; 3—the direct-fired system. However, for discussion purposes he preferred to set up four distinct systems instead of the usual three. The four which he set up are: 1—the split system; 2—the divided system; 3—the indirect system, and 4—the direct-fired system. He then discussed each of these systems and showed how they differ from each other. He also presented slides illustrating equipment suitable for accomplishing air conditioning with each one of these equipment arrangements.

At the Wednesday morning session A. J. Chouinard urged coal merchants to adopt merchandising methods. He advocated market studies and felt that progressive coal dealers should take on a stoker agency to promote the sale of coal.

F. K. Scoggins, Minneapolis-Honeywell Regulator Company, presented a paper on "Automatic Controls for Domestic furnaces and Air Conditioning Appliances" in which he described the automatic controls now available and the functions which they perform on furnaces and air conditioning appliances.

Harry Neal Baum, Fairbanks, Morse Company, felt that coal salesmen and stoker salesmen should draw more closely together since both are aiming at increasing the use of coal. He felt that stoker men and the coal merchant should unite to oppose the inroads made by oil and gas fuel.

J. R. Fellows, associate on the University staff, told of a development on which he has been working in an attempt to produce a low-priced device for burning coal without smoke. This was referred to as the "Poor Man's Stoker." According to Mr. Fellows, a downdraft conversion burner offers an inexpensive device for installation in existing furnaces. Uniform temperatures are easily maintained without automatic controls, according to his tests. Smoke is eliminated even where very high volatile coals are used. If the coal spreader is properly designed there are no clinkers. His device consists of two parts which may be inserted in the feed door of any ordinary furnace.

At the Wednesday afternoon session K. C. Richmond, "Coal-Heat," declared that dustless coal, high heat content, and ease of operation are the characteristics demanded in stoker coal. He also felt that fully 150,000 coal stokers would be installed during the course of the present year.

In the absence of J. H. Murphy, the paper "Domestic Hot Water Supply the Year 'Round" was presented by J. D. Wallace, Taco Heaters, Inc. Mr. Wallace described the method of heating whereby the stoker when properly controlled can be used to furnish a domestic hot water supply throughout the year. His method, he stated, can be used in the smallest as well as the largest building, is economical and practical, and there is no reason why a large part of the domestic water heating fuel should not be coal.

A. F. H. Scott, Anthracite Industries, Inc., spoke on "The Heating Equipment Problem." He told of the intensive campaign being made by the anthracite coal industries to bring anthracite back into its dominating position as a domestic heating fuel. He regarded the advent of automatic heating as an opportunity for anthracite coal to regain its position.

Following the annual banquet and entertainment held Wednesday evening the Thursday morning session listened to papers on "Portable Test Instruments" by W. H. Pugsley, Hays Corporation, and "Problems of Dustless Treatment," by H. H. Morris, Sun Oil Co.

Dr. F. H. Reed, Illinois State Geological Survey, in his paper "Chemical Aspects of Coal Utilization" predicted that coal would replace oil as a fuel. He pointed out several methods by which liquid fuels can be derived from coal but felt that these methods are relatively expensive and inefficient. Ivan Given, "Coal Age," reviewed recent trends in using and preparing coal in his paper "Recent Developments in and the Trend of Bituminous Coal Preparation."

At the closing session Thursday afternoon papers were presented by A. C. Smith, The Consolidated Coal Company, who dealt with the subject of "Selling Steam Coal from an Engineering Viewpoint," and T. A. Marsh, Iron Fireman Manufacturing Company, who illustrated his talk on the "Advantages and Limitations of the Spreader Type Stoker" by exhibiting colored movies emphasizing his points.

Odor Control Discussed at ASRE Meeting

THE growing use of refrigeration on farms and the latest developments in the refrigeration of foods and refrigerated transport were the chief theme of the 24th spring meeting of The American Society of Refrigerating Engineers, held June 8-9-10 at the French Lick Springs Hotel, French Lick, Ind. An attendance of more than 180 was registered at the convention, at which members of the St. Louis and Chicago Sections of the Society served as hosts.

Harry M. Williams, Frigidaire, president of the ASRE, presided at the first session on June 8, with Prof. John E. Nicholas of Penn State giving an introductory talk sketching the broad possibilities for refrigeration experts in designing practical equipment for farm use and developing that market. That designers should find out exactly what refrigeration machinery the farmer wants and make such equipment available, rather than tell him what he should have, was emphasized in the talk given by Mack Tucker of the Tennessee Valley Authority under the title, "Farm Refrigeration Equipment That Earns Its Keep." Mr. Tucker reported on small milk cooling installations and cooperative farm cold storages which have been made under the direction of the University of Tennessee and the Tennessee Valley Authority, reporting actual cash savings and marketing profits made by farmers using refrigeration in these ways.

Cold storage for apple crops and for vegetable farms, refrigeration equipment on dairy farms and for the precooling of eggs, and refrigeration for the farm household which covers marketable produce as well as the family food supply were discussed by Truman E. Hienton of Purdue University, who described many installations now in use in the middle west which have increased farmers' profits materially in the sale of these products. Mr. Hienton believes that the problem of refrigeration for the farm household needs further consideration, in view of the recent rapid development of farmers' locker storages, which may remove the necessity for large capacity individual boxes for each farm.

A review of "Poultry Freezing Methods" was presented by Paul Mandeville of the Institute of American Poultry Industries in Chicago, including a complete bibliography of scientific work done along this line both here and abroad. Mr. Mandeville's paper was followed by a study of "Seasonal Variations in Vitamin C Content in Fresh Market Vegetables" by Sidney L. Feener, Virginia Wallis Palmer, and Gerald A. Fitzgerald of the Bird's Eye Laboratories, Boston, which was presented by Gardner Poole, vice-president of Frosted Foods, Inc., and vice-president of the ASRE. This report of experimental work demonstrated clearly that with proper refrigeration applied throughout the marketing period, the vitamin C potency of fresh market vegetables may be preserved during a normal marketing period almost intact, and that in marketing fresh vegetables without refrigeration, delays in transport and damage in handling sometimes reduce the vitamin C content by a large percentage.

An extremely interesting account of a balloon expedition to the stratosphere was given by Major Chester L. Fordney, U. S. Marine Corps, at the welcome luncheon held on June 8, which all ASRE members and their women guests attended. Crosby Field, president of the Flakice Corporation and vice-president of the ASRE, presided at this event. Major Fordney's talk, skilfully planned to interest both the engineer and the layman, confirmed the Society's belief that speakers at these general events may well be chosen from scientific fields outside the immediate interest of the members.

The report of the ASRE committee on the promotion of standards was presented at the second session of the convention on June 9 by Chester Lichtenberg, General Electric, chairman of the committee. Gardner Poole, vice-president of the ASRE, presided at this session. After careful consideration of a number of specific projects, the committee has recommended that the ASRE committee for the preparation of standards consider and act upon six definite projects: standards of measurement, methods of rating and testing refrigerant expansion valves and sizes of refrigerant lines, methods of rating and testing self-contained drinking water coolers, methods for rating and testing self-contained, can-type milk coolers, a test code for unfired refrigerant containing vessels, and methods of testing refrigerated trucks.

"Progress in Ice and Mechanical Refrigerator Cars" was the subject of a paper presented by George E. Hulse of the Safety Car Heating and Lighting Company, at this session, which was devoted to the general subject of the refrigeration of foods and refrigerated transport. Mr. Hulse reported that at present the trend of development is away from systems which produce the required refrigeration on the car and towards the retention of an arrangement by which refrigeration is furnished by a medium which is cooled in a stationary refrigerating plant, and transferred to the car to absorb heat and keep the car at the proper temperature. It was agreed in the general discussion following the presentation of this paper that while the mechanically refrigerated car has advantages in the uniformity of temperature distribution throughout the load, the ice cooled car is superior from an economic standpoint. Mr. Hulse described the construction of the newer refrigerator cars, in which better insulation is used than in the past, and steel construction increases durability and provides a better seal against the entrance of moisture into the insulation.

A report of recent tests of all railroad air conditioning systems now in use, including data from 594 cars, was discussed informally by C. C. Elmes, manager of research for the American Railways Association in Chicago, who urged further cooperation between his own organization and the ASRE in attaining railroad air conditioning of even greater efficiency and economy.

W. R. Kitzmiller of the Frick Co., Waynesboro, Pa., gave an interesting description of refrigerated trawlers of the latest construction, now in use in the Boston fishing area, showing how the combined use of ice and mechanical refrigeration in these boats affords the best available refrigeration for the transport of this highly perishable product over a considerable period of time.

The final paper on the Tuesday program was an account of "Refrigeration in a Packing Plant," presented by L. C. Leslie, Johns-Manville, with E. J. Berlet, York, as co-author. Mr. Leslie described a recent installation made in the packing plant of the Arbogast and Bastian Co., Allentown, Pa., emphasizing the need for careful control of humidity in meat cooling and storage rooms if meat products are to be held satisfactorily.

An interesting study of "Odor Control Methods" was presented at the closing session of the convention on June 10 by F. H. Munkelt, manager of the Consolidated Air Conditioning Corp., New York. Dean E. Perham, chairman of the Chicago Section of the ASRE, presided. Mr. Munkelt pointed out that the field of the odor remover is wide and that it presents an opportunity to designing engineers to economize not only in the cost of the installation but also in the cost of operation. His data indicated that if a room were designed for an occupancy of 1000, and if conditions of occupancy were such that the installation of odor removers permitted a reduction of 13 c.f.m. per person from outdoor air and a like addition to the recirculated air, a total of 13,000 c.f.m., and if the assumed outdoor temperature is 85F, 50% relative humidity, the savings in refrigeration would be a total of 37 tons. Likewise, a reduction from the outside air of 16,000 c.f.m., and an assumed outdoor temperature of 95F, shows a saving of 60.8 tons of refrigeration. He declared that of the various methods proposed for the control of odors, the method of removal by solid adsorbents is the only one which actually removes the odor, and that an adsorbing material which embodies all the properties desired for air conditioning work is activated carbon manufactured from coconut shells.

"Improvements in Household Refrigerators" were outlined in an informal paper presented by E. B. Newill, vice-president of Frigidaire, who demonstrated with data compiled from tests of several makes of refrigerators that the 1937 mechanism and better constructed cabinets are achieving results far superior to the models of 1932, both from standpoint of low temperatures and increased production of ice, as well as lower kilowatt-hour consumption per day. Mr. Newill listed refinements which have been made in compressor and evaporator design making this improvement possible.

"Heat Interchangers in Commercial Refrigeration" was the title of a paper presented by W. L. Knaus, General Electric, who was followed by L. W. Child of the Bendix Products Corporation, presenting "A New Freon Chart." Mr. Child's contribution led to a profitable general discussion of how the various refrigerant charts may be improved and combined in the next edition of the Refrigerating Data Book to afford greater accuracy and convenience in use. The final paper on the last program, presented by title only, was "Viscosity and Reynold's Number," by J. R. Zwickl of the Baldwin-Southwark Corp., Philadelphia.

ASRE members and their wives and guests on hand for the French Lick meeting enjoyed a delightful entertainment program for the three days, arranged by the committee under the direction of J. L. Shrode, president of Alco Valve Company and past president of the St. Louis Section of the Society. Other members of the committee were D. E. Perham, chairman of the Chicago Section; B. E. Seamon, secretary of the Chicago group; H. C. Morrison, F. C. Laufketter, Ernest F. Vilter, F. D. Turner, A. B. Schellenberg, and Louis S. Morse, Jr. Mr. Schellenberg had secured a list of handsome prizes, presented by thirty manufacturers in the refrigerating and air conditioning field and valued at more than $500, and awards were given to winners in the Society's annual golf tournament, tennis matches, skeet shooting matches, for the ladies' bridge, and door prizes for the convention dinner-dance given on the evening of June 9. The midwestern site of this meeting permitted a greater attendance than usual of refrigerating engineers in that region, with the attendance comparing favorably with spring meetings held in the East.

At the meeting of the ASRE Council held on June 9 it was voted to hold the 33rd annual meeting of the Society in January, 1938, in New York, during the Heating and Ventilating Show and on the same dates as the annual meeting of the American Society of Heating and Ventilating Engineers. A feature of the meeting will be a joint session with the heating and ventilating engineers.

Installation Code for Air Conditioning Revised by Fire Protection Group

Rapid developments in the art have made necessary the revision of the code for installation of blower systems, including air conditioning and exhaust systems, adopted in 1936 by the National Fire Protection Association. The revised code, adopted at the Association's annual meeting in May, contains a new section — that on warm air heating and air conditioning in residences. In view of the wide interest in this form of heating and the importance of adequate provision for fire prevention in design and installation work, the first two parts of the code are printed here.

THE 1937 edition of Regulations for the Installation of Power-operated Ventilating, Air Conditioning, Dust, Stock and Vapor Removal Systems is a revision of the 1936 code of the National Fire Protection Association. The regulations on air conditioning and ventilating systems have been rewritten and divided into Part I (for other than residences) and Part II (for residences); these parts have been completely separated from the regulations on blower and exhaust systems for flammable dusts and vapors which now appear as Part III of the code. Parts I and II are reproduced here.

The rewriting of the code was made necessary by the rapid development of the art and the regulations were adopted at the meeting of the National Fire Protection Association in Chicago during May and given formal approval by the board of directors June 21.

The regulations were rewritten by the Association's committee on blower systems, consisting of the following members: Carl W. Wheelock, chairman; J. L. King, secretary; C. A Booth, H. C. Murphy, Sterling S. Sanford, W. E. Zeiber, E. W. Fowler, F. A. Faust, Charles N. Hagar, C. B. Langdon, David J. Price, Benjamin Richards, H. Oram Smith, and Fitzhugh Taylor.

In these regulations the following words are used as defined below: *Shall* is intended to indicate requirements; *should* is intended to indicate recommendations, or that which is advised but not required; *approved* refers to approval by the authority having jurisdiction in the enforcement of the regulations.

Part I — Regulations for the Installation of Air Conditioning and Ventilating Systems in Other than Residences

100. Application and Scope.

101. These regulations apply to air duct systems employing mechanical means for the movement of air and used for heating and ventilating, including warm air heating systems, plain ventilating systems, combination heating and ventilating systems, air cooling systems, air conditioning systems, and exhaust systems. They do not apply to systems in residences nor to systems for removal of flammable vapors and residues nor to systems for conveying dust, stock or refuse by means of air currents.

(Note: For systems in residences, see Part II of these regulations.)

102. These regulations are intended to prescribe reasonable provisions based on minimum requirements for safety to life and property from fire.

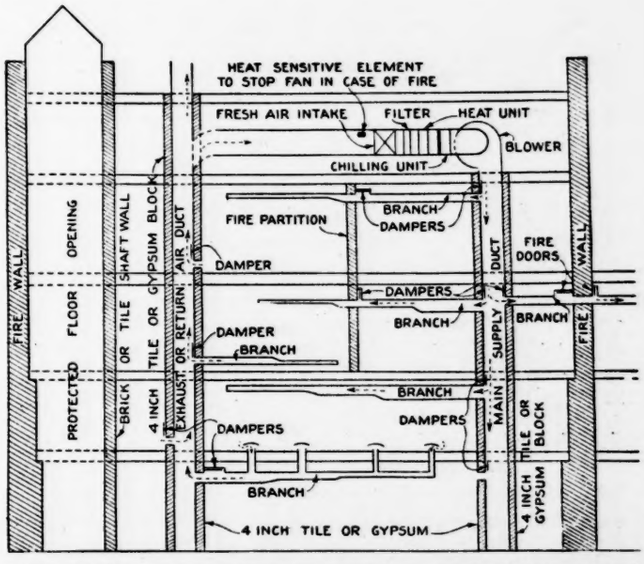
110. Construction of Ducts.

111. Ducts shall be constructed entirely of non-combustible material, such as iron, steel or other approved material.

112. Ducts may be of independent construction or a part of the building structure, provided that they are installed in accordance with the requirements of these regulations. Construction consisting of not less than ¾-inch cement or gypsum plaster on metal lath applied to either combustible or non-combustible supports may be used as duct walls.

113. Flexible woven asbestos or other approved fire-resistive material or sleeve joints with rope asbestos packing or other approved non-combustible material shall be provided where flexible connections to prevent transmission of vibrations through the duct system are desired. This requirement does not apply to the joint connecting fans, where the intake or discharge of the fan is in the same room or enclosure as the joint.

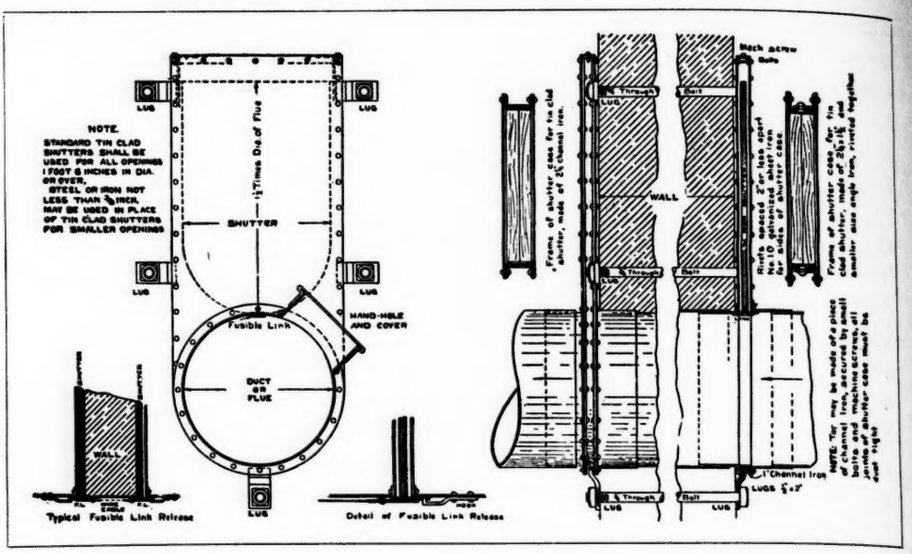
114. Only fire-resistive linings acceptable to the inspection department having jurisdiction may be used inside of ducts.



CAUTION: This drawing has not been revised to conform with the new code in one respect: unprotected ducts passing through the first floor must be protected as provided in Sections 124 and 135.

Fig. 1. Typical installation of air conditioning system, in building of "fireproof," "semi-fireproof" or heavy timber construction. See Figs. 2 and 3 for dampers and firedoors.

Fig. 2. Suggested type of vertical dust shutter for openings in firewalls.


NOTE.
STANDARD TIN CLAD SHUTTERS SHALL BE USED FOR ALL OPENINGS 1 FOOT 6 INCHES IN DIA. OR OVER. STEEL OR IRON NOT LESS THAN ⅛ INCH MAY BE USED IN PLACE OF TIN CLAD SHUTTERS FOR SMALLER OPENINGS
LUG
1½ Times Dia of Flue
SHUTTER
Fusible Link
HAND-HOLE AND COVER
DUCT OR FLUE
Typical Fusible Link Release
Detail of Fusible Link Release
WALL
Bolt
Through
Channel Iron

115. Ducts shall be so constructed as to provide structural strength and durability at least the equivalent of galvanized sheet iron or steel of the thickness specified in Table 1.

TABLE 1—THICKNESS OF METAL FOR AIR DUCTS

Round Ducts Diameter (Inches)	Rectangular Ducts Width (Inches)	Minimum Thickness U. S. Gauge
6 to 10	Up to 12	26
11 to 29	13 to 30	24
30 to 39	31 to 60	22
40 to 49	61 to 118	20
50 and above	119 and above	18

116. Ducts shall be made reasonably tight throughout and shall have no openings other than those required for the proper operation and maintenance of the system.

120. Installation of Ducts.

121. In no case shall the clearance from metal ducts to stored combustible material be less than six inches, and to combustible construction, including plaster on wood lath, it shall not be less than ½ inch.

122. Where ducts pass through walls, floors or partitions the space around the ducts shall be sealed with rope asbestos, mineral wool or other non-combustible material to prevent the passage of flame and smoke.

123. Where ducts pass through concealed ceiling spaces of combustible construction or are located inside combustible partitions or walls, either the ducts or the interior surfaces of such concealed ceiling space, partition or walls shall be protected with ¼-inch asbestos or other approved insulating material or a clearance of ½ inch as specified in Rule 121 shall be maintained between ducts and all combustible construction. The integrity of fire-stopping shall not be destroyed. The spaces between the ducts and the fire-stopping shall be filled solidly with brick, asbestos, mineral wool or other approved non-combustible material.

124. Ducts which pass through floors of "fireproof construction," "semi-fireproof construction" or heavy timber construction, in which vertical openings are generally protected, shall be incased in 4-inch hollow clay tile, 4-inch gypsum block or their equivalent. Such construction, however, shall not be required for branches which are cut off from the main portion of the duct by approved fire dampers.

125. No room, attic, concealed space or other portion of a building shall be used as an integral part of a duct system unless it conforms to all the requirements for ducts. Such arrangements shall be subject to the approval of the inspection department having jurisdiction.

Plenum chambers which conform to all the requirements for ducts may be located in any such portion of the building; such chambers shall not be used for storage or occupational purposes.

126. Ducts shall not be built into a building in such a way as to impair the effectiveness of the fireproofing around steel or iron structural members, such as placing ducts between the fireproofing and the members protected.

127. Ducts should not be located where they will be subject to damage or rupture. Where so located they shall be suitably protected.

128. Ducts shall be substantially supported. Hangers and brackets for supporting ducts shall be of metal.

130. Automatic Fire Doors and Dampers.

131. The passing of ducts through fire walls should be avoided wherever possible. When ducts or the outlets from or inlets to them pass through fire walls, they shall be provided with approved automatic fire doors on both sides of the wall through which they pass. (See Figs. 2 and 3.) On small openings not exceeding 18 inches in diameter, ⅜-inch steel plates may be used in lieu of fire doors.

(Note: A fire wall is defined in the Building Code recommended by the National Board of Fire Underwriters as "a wall which subdivides a building or separates buildings to restrict the spread of fire and which starts at the foundation and extends continuously through all stories to and above the roof.")

132. Fire dampers installed in the system, as required at other than fire wall openings, shall be No. 16 U. S. gauge metal on ducts up to 18 inches in diameter or greatest width, No. 12 U. S. gauge on diameters up to 36 inches or greatest width and No. 7 U. S. gauge on ducts above 36 inches in width. One-half inch approved rigid asbestos sheet material may be used at

points where metal dampers are specified, when permission of inspection department having jurisdiction is granted.

133. Fire doors and fire dampers shall be arranged to close automatically and remain tightly closed, upon the operation of a fusible link or other approved heat actuated device located where readily affected by an abnormal rise of temperature in the duct. Hinged dampers shall be equipped with spring catches and pins of hinges shall be of corrosion-resistant material.

134. An approved fire damper shall be provided on each opening through a required fire partition.

(Note: A fire partition is defined in the Building Code recommended by the National Board of Fire Underwriters as "a wall or partition which subdivides a story of a building to restrict the spread of fire or to provide an area of refuge," and to be so classed must have a fire resistance rating of not less than two hours. A required fire partition is one which is required by the provisions of said building code or by the regulations applying to some specific occupancy.)

135. When ducts pass through floors and serve more than one story, approved fire dampers shall be provided at all outlet and inlet openings, including branches, to or from such main vertical ducts.

136. Outside air intake openings shall be protected with approved automatic fire doors or dampers except where permission to omit them, because of light exposure, is granted by the inspection department having jurisdiction. When deemed necessary by inspection department having jurisdiction, approved heat actuated devices shall be installed at intake openings to shut fans down in case of exposure fires.

137. Fire doors at openings through fire walls and fire dampers at fire partitions shall be so arranged that the disruption of the duct will not cause failure to protect the opening.

(Note: This may be accomplished by locating the fire door or damper in a collar securely fastened to the wall as shown in Figs. 2 and 3.)

140. Air Intakes and Outlets.

141. Air shall not be re-circulated from any space in which objectionable quantities of flammable vapors, flyings or dust are given off.

142. When located less than seven feet above the floor, air inlet and outlet openings shall be protected by a substantial grille or screen of one inch or smaller mesh.

150. Air Filters.

151. Combustible air filters should not be used unless they are in themselves, or by treatment, sufficiently fire-resistive so that fire spreading over the filter when loaded with dust and under operating conditions will not be materially fed by burning of the filter itself.

Adequate sprinkler protection should be installed to protect combustible air filters. Suitable provision should be made for drainage. In buildings not equipped with automatic sprinklers, the water supply may be taken from the house piping, if the supply is adequate for the purpose.

152. Liquid adhesive coatings used on air filters shall have a flash point not lower than 350° F., Cleveland open cup tester.

153. Oil tanks into which removable filters are dipped should preferably be located outside the building or in a separate fire-resistive room. Such tanks shall be of metal, equipped with tight-fitting covers and shall be kept tightly covered when not in actual use.

154. Where filters are flushed with oil flowing through the air stream the system shall be arranged so that the filters cannot be flushed while the fan is in operation.

155. All air filters shall be kept free of excess dust and combustible materials. If of the automatic oil type, sludge shall be regularly removed from the oil reservoir and if of the replacement media type, the filter media shall be changed at proper intervals to eliminate excessive dust deposits.

160. Fans

161. The term "fans" as used in these regulations refers to the assembly comprising the blades or runners and housings or casings and includes both blowers and exhausters.

Blowers are fans used to force air under pressure into the affected areas.

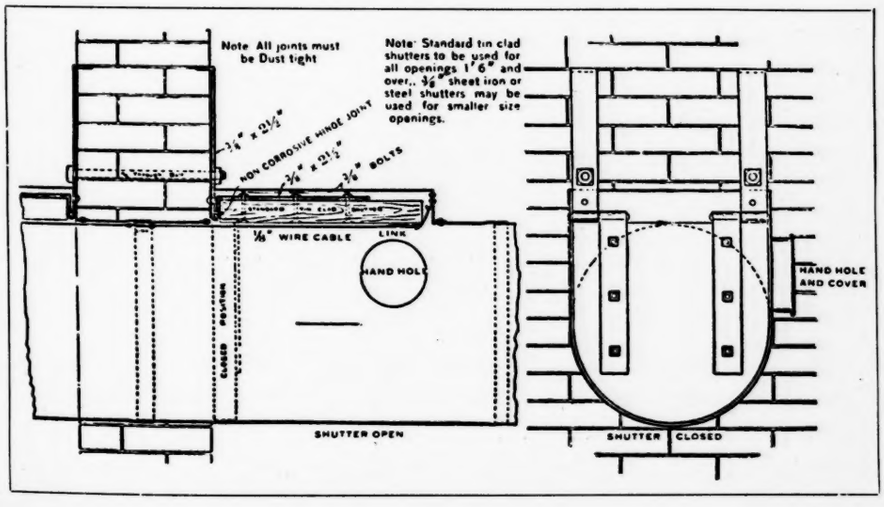

Note All joints must be Dust tight
Note Standard tin clad shutters to be used for all openings 1'6" and over, 1/8" sheet iron or steel shutters may be used for smaller size openings.
NON CORROSIVE HINGE JOINT
3/4" BOLTS
1/8" WIRE CABLE
LINK
HAND HOLE
HAND HOLE AND COVER
SHUTTER OPEN
SHUTTER CLOSED

Fig. 3. Suggested type of automatic hinged duct shutter for openings in firewalls.

Exhausters are fans used to withdraw air from the affected areas under suction.

162. When installed, fans shall be so located and arranged as to afford ready access for repairing, cleaning, inspection and lubricating. They should be placed on proper foundations or firmly secured to substantial supports.

163. Exposed openings into fan housings shall be protected with substantial metal screens or gratings to prevent accidents or the entry of foreign material.

164. Fans and air handling equipment connected thereto, such as washers, filters and heating and cooling units, shall be located in a room cut off from other portions of the building by construction having a resistance rating of not less than one hour, where either of the following conditions prevail:

(a) The main portion of the duct system served by the fan passes through floors of fireproof, semi-fireproof or heavy timber construction and where vertical openings are generally protected;

(b) The system serves more than a single room of a public or institutional building.

Examples of public buildings are schools, libraries, exhibition buildings, dance halls and theatres; of institutional buildings, hospitals, asylums, sanitariums and jails.

170. Controls.

171. Each installation shall be equipped with a manual control, located at a conveniently accessible point, for quick shutting down of the fan in case of fire. This location should be submitted to the inspection department having jurisdiction for approval.

172. In systems utilizing re-circulation, serving more than one story of a building, or more than one fire section of a single story, fans shall be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from a fire. For this purpose an approved manually reset thermostatic device, with a maximum setting of 125° F., shall be located in the system at a suitable point in the return air duct ahead of the fresh air intake. In sections of the country with moderate summer temperatures it will be desirable and practical to moderately reduce the above temperature setting.

180. Electric Wiring and Equipment.

181. Electric wiring and equipment shall be installed in accordance with the National Electrical Code.

190. Air Cooling and Heating Equipment.

191. Coils carrying refrigerants which are flammable or which are classified by Underwriters' Laboratories, Inc., in toxicity classification Groups 1 to 4 inclusive, shall not be placed in air ducts or other air circulating passages. Brine or water cooled by such refrigerants may be sprayed into such air passages or may be circulated through coils located in such passages, but no such brine shall contain any flammable constituent.

(Note: The classifications are those made by Underwriters' Laboratories, Inc., in their report on the Comparative Life, Fire and Explosion Hazards of Common Refrigerants. Refrigerants which are flammable or which have been classified by Underwriters' Laboratories, Inc., in toxicity classification Groups 1 to 4 include: Ammonia; butane; dichlorethylene; ethane; ethyl bromide; ethyl chloride; methyl bromide; methyl chloride; methyl formate; propane; sulphur dioxide.

Refrigerants which are both non-flammable (or practically so and for the purpose of these regulations are so considered) and have been classified by Underwriters' Laboratories, Inc., as less toxic than Group 4 include: carbon dioxide; dichlorodifluoromethane (F-12); dichloromonofluoromethane (F-21); dichlorotetrafluoroethane (F-114); monofluorotrichloromethane (F-11); methylene chloride (dichloromethane).

(Note: It is recommended that joints in refrigerant carrying parts, when located in the air stream, shall be constructed in such a manner as to resist without failure a temperature of not less than 1000° F.)

192. Unless otherwise provided by these regulations mechanical refrigerating equipment shall be installed in accordance with the American Standard Safety Code for Mechanical Refrigeration.

193. Heating equipment shall be installed in a standard manner with due regard to proper clearance between hot surfaces and woodwork and other combustible materials.

(Note: The inspection department having jurisdiction should be consulted regarding standard requirements for installation of heating equipments.)

Part II — Regulations for the Installation of Warm Air Heating and Air Conditioning Systems in Residences

300. Application.

301. These regulations apply to air duct systems in residences; that is to systems such as are used for heating, ventilating or cooling or any combination of these functions (including air conditioning), either with or without a fan.

(Note: For systems in multi-family houses (more than two families) and in buildings of other than residential occupancy, see Regulations for the Installation of Air Conditioning and Ventilating Systems in Other Than Residences, in Part I of these regulations (Rules 100 to 193 inclusive).)

302. These regulations are intended to prescribe reasonable provisions based on minimum requirements for safety to life and property from fire.

310. Warm Air Delivery Ducts of Systems Using a Direct-Fired Furnace, except as provided under Rule 350 for lower temperature systems.

311. Such ducts shall be constructed entirely of non-combustible material equivalent in structural strength and durability to No. 28 U. S. gauge galvanized iron or steel, provided that ducts 12 inches or more in diameter, or 14 inches or more in greatest width, shall not be made of material lighter than No. 26 U. S. gauge galvanized iron or steel.

312. Only fire-resistive linings acceptable to the inspection department having jurisdiction may be used inside of ducts.

313. Joints and seams of such ducts shall be secure-

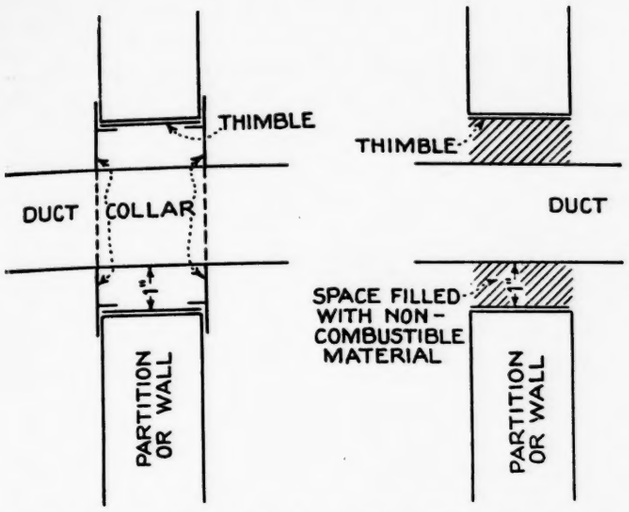


Fig. 4. Two arrangements for passing ducts through combustible walls or partitions as specified in Rule 320.

ly fastened and made substantially air tight. Slip joints shall have a lap of at least one inch, and be individually fastened.

314. Such ducts shall be securely supported by metal hangers, straps, lugs or brackets. No nails shall be driven through the duct walls and no unnecessary holes shall be cut therein.

315. Portions of such ducts which run in the open, such as those which run approximately horizontal and near the ceiling, shall have clearances as follows:

(a) From metal ducts to combustible material, including wood lath and plaster—not less than one inch:

(b) From metal ducts to metal lath and plaster or other non-combustible finish attached to combustible material—not less than ¼-inch;

(c) For metal ducts covered with ½-inch or more of non-combustible insulating material—no clearance required;

(d) From ducts made of asbestos-cement or equivalent to combustible material—one-half that specified for metal ducts.

316. Such ducts shall not enter a floor, partition or enclosure of combustible construction within a horizontal distance of six feet of the furnace. This is not intended to prohibit so-called pipeless furnaces. (See Rule 333.)

317. Where such ducts enter the floor of the first story above that in which the furnace is situated, they shall, whether of single or double wall construction, be separated from all combustible material in the floor construction by at least 5/16 inch, which space shall be tightly filled with asbestos cement or other non-combustible insulating material.

318. Where such ducts are enclosed in combustible partitions, walls or concealed ceiling spaces,

(a) They shall be covered with not less than one thickness of asbestos paper weighing not less than 12 pounds per hundred square feet, with an air space of not less than 5/16 of an inch provided between the duct and combustible material, unless a non-combustible insulating covering of cellular type at least ¼-inch thick is provided. (In metal lath and plaster partitions no air space is needed except from wood studs);

(b) Or, such ducts shall be made double with a continuous air space of not less than 5/16 of an inch between the inner and outer walls;

(c) Or, such ducts shall be of ¼-inch thick asbestos-cement or equivalent, separated from combustible material by an air space of at least ⅛-inch.

319. Where such ducts are located in closets they shall be covered with not less than ⅜-inch of asbestos or other approved fire-resistive insulating covering properly protected against injury; or they shall be made double with an air space of not less than one inch between the inner and outer walls.

320. Where such ducts pass through, i.e., pierce a wall or partition of combustible construction, they shall be protected as specified in Rule 319 above. A metal thimble may be used to provide the double wall if the space between the duct and the thimble is not less than one inch. This space may be filled with non-combustible material or closed with metal collars. (See Fig. 4.)

321. Where the installation of such ducts in walls, floors or partitions requires the removal of any fire-stopping, the spaces around the duct at such points where fire-stopping was removed shall be tightly filled with asbestos, mineral wool or other non-combustible insulating material.

330. Warm Air Registers of Systems Using a Direct-Fired Furnace.

331. Where such registers are placed in floors or walls of combustible construction they shall be made with or surrounded by a border of non-combustible material not less than 2 inches wide, securely set in place. Other methods of installation which give equivalent protection will be acceptable. (See Fig. 5.)

332. The register boxes of such registers, except as required by Rule 333 below, shall be constructed and installed in accordance with the requirements for warm air ducts. (See particularly Rules 311, 313, 314, 317 and 318.)

333. Where such registers are installed in the floor over the furnace (as in a so-called pipeless furnace) the register box shall be constructed double with an air space of not less than 4 inches between, except where the warm air passage is surrounded by a cold air passage.

340. Automatic Control of Higher Temperature Direct-Fired Heaters.

341. Direct-fired air heaters which are automatically controlled from a house thermostat shall be equipped with an approved automatic device to limit the air temperature in the furnace bonnet or at the beginning of the main supply duct. The automatic device shall be such that it cannot be set higher than 250° F. and a setting higher than 200° F. is not recommended.

350. Warm Air Delivery Ducts of Lower Temperature Systems.

(Note: This section applies to the following systems:

(a) Systems using low-pressure steam or hot water for air heating.

(b) Systems using automatic direct-fired furnaces with approved automatic devices limiting the air

temperature at the beginning of main supply ducts and having a maximum possible setting of 175° F.)

351. Construction and installations of such ducts shall comply with the provisions of Rules 311, 312, 313, 314, 315 and 319 with fire-stopping in accordance with Rule 321.

352. Where such ducts enter the floor of the first story above that in which the furnace is situated the space around the duct at such points shall be tightly filled with asbestos cement or other non-combustible insulating material.

360. Cold or Return Air Ducts.

361. Such ducts, except as required by Rule 362 below, may be constructed of metal, wood or other suitable material, provided that no wood thinner than one inch nominal thickness and no material more flammable than one inch wood boards, shall be used.

362. Portions of such ducts within 6 feet of the heater shall be constructed in accordance with the provisions of Rule 311 for warm air ducts.

363. Where such ducts are installed in walls, floors or partitions their installation shall comply with the provisions of Rule 321 regarding fire-stopping.

364. Where spaces between studs in walls or partitions or spaces between joists in floors are used as ducts, the portions of such spaces so used shall be cut off from all remaining unused portions by tight fitting stops of sheet metal or of wood not less than 2 inches thick.

365. The interior of combustible ducts shall be lined with metal at points where there might be danger from incandescent particles dropped through the register, such as directly under floor registers and at bottom of vertical ducts.

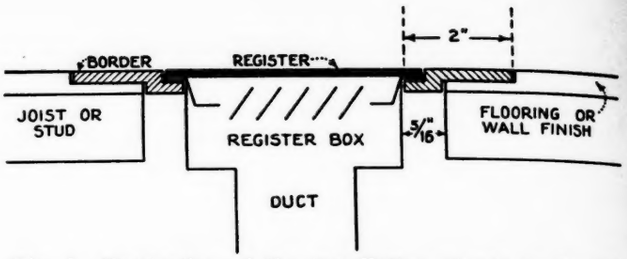


Fig. 5. Illustration of the installation of non-combustible border around warm air registers in floors or walls as specified in Rules 331 and 332. Protection for combustible material is to be provided in the 5/16 in. clearance space as specified in Rule 317 or 318.

366. No vertical stack for return air shall be connected to registers on more than one floor.

367. Return of air from the first floor to the basement through open registers and without continuous duct is prohibited; also the taking of air from any basement section not used for living quarters.

370. Air Filters.

371. Combustible air filters should not be used unless they are in themselves, or by treatment, sufficiently fire-resistive so that fire spreading over the filter when loaded with dust and under operating conditions will not be materially fed by burning of the filter itself.

372. Liquid adhesive coatings used on filters shall have a flash point of 350° F., Cleveland open cup tester, or higher.

380. Electric Wiring and Equipment.

381. Electric wiring and equipment shall be installed in accordance with the National Electrical Code.

390. Air Cooling and Heating Equipment.

391. Air cooling and heating equipment shall be installed as required under Section 190, Part I.

School to Give "Engineering Horse-Sense" Tests

TESTS to measure "engineering horse-sense" in incoming students have been adopted by the Cooper Union Engineering Schools, it is announced by Dean George F. Bateman. The tests will be included experimentally in the aptitude examination to be taken in the fall by more than 2000 applicants, less than one-seventh of whom can be admitted, owing to physical limitations of the schools, Dean Bateman said.

While the "horse-sense" tests will have no bearing on the success or failure of the candidates this year, the results will be used as a guide for devising future quizzes taking into account inherent fitness for the engineering profession as well as intellectual aptitude, it was explained. Admission to Cooper Union is based solely on the aptitude tests, which are competitive.

"In the past we have had too many tragic experiences with boys who came to the school with brilliant records in secondary school work, and who scored among the leaders in the mathematics aptitude test for entrance, only to crack up badly before their first year was completed," declared the Dean.

"Possession of a brilliant mind is not necessarily indicative in itself of engineering promise. A boy may have a quick mind, but lack the mechanical flair and the ability to visualize engineering problems that an engineer must have. Again, the brilliant boy frequently lacks the plodding sort of stamina that is essential to successful work in a good technical school.

"Balance, above all things, is required of the good engineer, and balance is what the brilliant boy often lacks. It is not enough to be able to arrive swiftly on paper at a solution to a problem. The engineer does not build on paper. The solutions to his problems must work as he visualizes they will work.

"It is this balance, this practical sense of engineering, whatever it might be called, that we want our admissions to have. Our academic casualty rate is too high, despite the unusual selectivity we exercise. Approximately one applicant in seven can be admitted to the Day School of Engineering, and of those admitted, only 65%, and in some classes as few as 45%, can be expected to graduate.

"To prevent this waste the new tests are being constructed. Scores made on them will for the time being not be counted in the applicants' averages for entrance, but they will be carefully recorded for comparison with the students' showing of engineering 'horse-sense' in the laboratory."

Summer Degree-Hours—An Estimating Unit for Summer Air Conditioning

Announcing a new monthly service in HEATING & VENTILATING covering summer temperatures in 23 cities

THERE is a fair amount of evidence that that part of the cooling load in air conditioning which depends on the outdoor dry bulb temperature is proportional to the number of hours the temperature is above 85F. The calculation of the number of these degree-hours in the summer depends on the availability of hourly dry bulb temperature readings and for that reason data can not be prepared for all cities. However, the table below gives the number of degree-hours for May for 23 cities. May is, in most cases, the beginning of the cooling season. In succeeding issues similar data for subsequent summer months will be presented for these same cities.

The degree-hour unit is similar to the degree-day unit used for winter estimating, differing however in one important respect—the number of degree-days in a given month in a given city usually compares within ± 20% of the number for the same month in other years; this is not the case with degree-hours which fluctuate all the way from zero to over 800 in the same month in different years. Consequently, the unit does not lend itself to predicting as does the degree-day unit. However it does enable one to make comparisons of a part of the sensible heat load, with the temperature variable eliminated. Note that the remarks in the table below usually refer to May, 1937.

Summer Degree-Hours (Above 85F), May, 1937

The figures below are for May, 1936 and 1937. In most of the cities listed the cooling season began in May, but in a few there is a small number of degree-hours in April; where this is the case the April figures for 1936 and 1937 are given under "Remarks." Unless otherwise stated, the remarks apply to the May, 1937, figures.

Degree-Hours, 1937	Degree-Hours, 1936	City	Remarks
61	128	Baltimore	Off 75% from 1934 but up sharply from 1935
48	47	Boston	A reasonably warm May
0	0	Buffalo	This city had 0 deg. hrs. each May since 1932
45	42	Chicago	Chicago had over 300 deg. hrs. in May, 1934, none in 1935
106	76	Cincinnati	Up from 0 in 1935
7	1	Cleveland	May seldom has much cooling load here
52	125	Columbus	Up from 0 in 1935; over 100 in 1934
14	70	Des Moines	This city had 7 deg. hrs. in April, 1936
35	48	Detroit	Up from 0 in 1935; there were nearly 100 in 1934
0	1	Duluth	There were 0 deg. hrs. in 1933 and 1935
33	11	Fort Wayne	Up from 0 in 1935; in 1934, over 100
51	14	Grand Rapids	In 1933 and 1935, 0 deg. hrs.
82	30	Indianapolis	Up from 0 in 1935; in 1934 nearly 125
65	—	Kansas City	No data for 1936
12	6	Milwaukee	Off 100 from 1934, up from 0 in 1933 and 1935
20	—	Minneapolis	No data for 1936
198	30	New Orleans	In May, 1933, this city had 300 deg. hrs. In April, 1936, 8 deg. hrs.
9	23	New York	An average May
22	131	Philadelphia	Up from 0 in 1933 and 1935
18	26	Pittsburgh	There were 0 deg. hrs. in 1933 and 1935
109	60	St. Louis	In April, 1937, there were 28 deg. hrs.; 21 in April, 1936
36	35	Toledo	Up from 0 in 1935; about half of 1934
33	114	Washington	This city had 36 deg. hrs. in April, 1937; 4 in April, 1936

Recruiting and Training Sales Engineers

THE astonishing increase in air conditioning sales has resulted in manufacturers being faced with the problem of obtaining trained sales engineers capable of instructing their present and prospective dealers and distribution outlets in the elements of the art. In a comprehensive discussion of this problem appearing in the Metropolitan Life Insurance Company's Executives Service Bulletin, Reuben N. Trane, president, The Trane Co., La Crosse, Wis., describes how his company recruits and trains its sales engineers:

The first step taken by the company was to start an air conditioning class at the factory where young college men were given an opportunity to spend some time in all of the plant departments. The company had been training men from technical schools since 1925, although originally the course was designed to instruct the men in heating sales engineering. At the present time the emphasis is naturally on air conditioning. Only those with a bachelor of science degree in mechanical, civil, electrical or chemical engineering were accepted, and the selection was based on the applicant's personality, possibilities for success, his past record in general, and, particularly, his desire to specialize in air conditioning. A prospectus outlining these requirements was sent to interested applicants and this prospectus contained full information about the company, its background, organization, and products. In this it was pointed out that of the 10 engineers who made up the first student class in 1925 all but two are still with the company.

Mr. Trane explained further that: Our conventional training course starts in June and ends in December. In it is included class work, but most of the time is spent in the various departments of the company on actual problems. The regular course aims to give our students an opportunity to become familiar with all phases of our activities. For instance, in the air conditioning division, we cover fundamentals, selection of equipment, design, layout, special application, products, theory and practice. A similar program is undertaken in the heating division. Also, we spend enough time in engineering design to understand how products are designed and why. In the research laboratory the student has an opportunity to work, not only with trained engineers but with Government inspectors and representatives of large organizations among our customers. When he reaches the factory the student is given practical production experience within the two to four weeks allowed there. Finally, students with special qualifications for certain types of work, such as advertising, research or design, spend extra time in these departments.

During the training period the student is financed by the company on the basis of $75 per month for the first two months, $85 per month for the next two months, and $100 per month for the last two months. We do not consider this payment as salary, as the value of the training, both to the student and to the company, cannot at this point in the student's career be measured in dollars and cents. We realize that students wish to be self-supporting, so we finance their training period for that reason. Students are selected with the view of placing them on the regular company payroll after the course is completed. There is, however, no obligation on the part of the company to the student. And there is no obligation on the part of the student to remain with the company.

All of the foregoing information was transmitted to certain schools, and the result was that in 1936 we enrolled 22 men in our air conditioning class, selecting them from about 200 applicants. The size of the class was determined by our facilities for handling the men and not by requirements for additional help. We found it very difficult to keep the men in the office until the course had been completed because, when our branch office men visited the home office, they became acquainted with the students and a spirited competition arose for their services. In a few cases we allowed the men to leave about a month before the completion of the prescribed six-month training course. Ten of the men were assigned to our own branch offices, four to suboffices, two to jobbers, four to dealers, and two were kept on our staff at the home office.

While this training work was getting under way we began to consider research. The idea was to secure data that could be used by air conditioning men who were not engineers. Existing data were so incomplete that trained judgment entered too much into the calculations. This was perfectly satisfactory when the central air conditioning division at the home office could handle all problems, but it proved woefully inadequate when projects multiplied overnight all over the country. Our own offices needed simple, definite data that could be passed along to dealers. And so the engineers of necessity moved to the laboratory to reduce their knowledge and experience to some more tangible form.

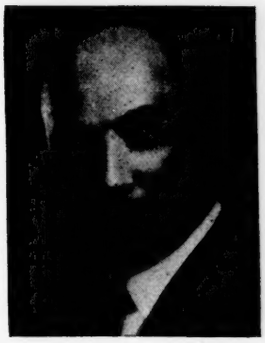
One of the problems that has confronted every air conditioning manufacturer is that of obtaining quiet and efficient fans.

Another problem which has engaged our laboratory is that of forecasting the exact performance of the cold coils used to cool and dehumidify air. This problem has been attacked by our engineers. The dividends paid by this research are extremely gratifying because they mean so much more than just profit in dollars to our company. Research enabled us to show our contractors how to increase their profits. Air conditioning had seemed to be a mysterious thing to most of them. It was gratifying to be able to dispel the mystery and point out to them the way to a better living.

Two educational aids are of general interest. One is the Trane air conditioning ruler. The other is the Trane psychrometric chart.

Similar problems were encountered years ago in heating, and were solved in a similar way. So the idea is not new. But it is still effective. We of The Trane Company feel that the manufacturer who sells through education is bound to profit most in this new field of endeavor.

NDHA Meets in Detroit, Awards Prizes for Papers, Hears Talks on Training of Salesmen



Thomas E. Purcell, newly-elected president of the National District Heating Association.

BREAKING recent attentance records the 28th annual convention of the National District Heating Association at Detroit on May 25 to 28 was featured by a wealth of carefully prepared committee reports and by a program of entertainment equally carefully planned.

Officers were elected at the closing session and immediately moved to start preparations to continue programs many of which were already well outlined. Thomas E. Purcell, Pittsburgh, became the new president; James R. McCausland, Philadelphia, first vice-president; Glen D. Winans, Detroit, second vice-president; while Edward Lenz, New York, formerly a member of the executive committee, was advanced to the post of third vice-president. Wm. H. Sanford, Philadelphia, was continued as secretary-treasurer. Members of the new executive committee are Melvin D. Engle, Boston, the retiring president; F. L. Witsell, Toledo, and J. M. Arthur, Jr., Kansas City, Mo.

Included among the features of the entertainment program were a visit to a Detroit radio station, theater parties, bridge and golf tournaments, trips to Cranbrook Foundation and Greenfield Village, and the usual dinner-dance and banquet.

As has been the custom in previous years, the convention program was arranged to furnish time for the presentation of reports on assigned subjects prepared under the direction of the major working committees of the association.

An innovation of the program of the membership committee consisted of a competition open to recent members with cash prizes awarded to the best paper dealing with any phase of district heating. Following his announcement of a gain in membership during the past year which brought the total to 474 members, Raymond M. Nee, Boston, announced the first prize winner as M. A. Ulbrich, Cambridge (Mass.) Electric Light Company. The author was present to receive the award following the presentation of his paper, Hot Money and Frozen Investments. Other prize-winners in this competition were announced and received their awards at a later session.

During the session held Tuesday afternoon, the distribution committee under the leadership of Wm. A. Herr, Philadelphia, presented the results of a study of the effects of design on the cost of underground steam lines and manholes. Comparisons of cost were prepared by various committee members taking into account variations in local costs. Tables showing labor and material costs estimated as necessary in the construction of a 12-in. steam line and manhole were presented in detail.

The cost figures given in the tables were based on a hypothetical set of unit costs with the exception of such items as insulation, pumps, roller supports, saddles, alignment guides, anchors, expansion joints, manhole covers and traps, in which cases local costs were used; however, these latter items accounted for only about 35% of the total cost. These costs were assembled to give a general picture only, and not to be construed as actual costs. The costs include only such labor as required to do actual construction work and did not include allowance for superintendence, timekeepers, overhead, interest during construction, engineering, and similar items.

The labor and material quantities and the costs given in the tables were based on uniform construction methods; the comparison therefore showed the effect of design on the costs. Different construction methods also affect the costs, and the chairman expressed the hope that studies will be made in the near future to ascertain what effect various construction methods have on the cost of these same designs.

Comparing the costs, it was interesting to note that there is a relatively small difference in the cost of the duct and piping and a relatively great difference in the cost of the manholes; also, that with some designs the cost of the manholes may become a relatively high percentage of the total cost of the job, especially when deep manholes and mechanical drainage are required.

It appears from this tentative study that two of the major factors affecting the cost of underground steam distribution lines are the depth and location of lines and manholes and the design of the manholes.

The distribution committee also included in its report the results of a study made to shed light on the question of the possibility of transmitting steam over long distances through pipes. Using a well insulated 18-in. steam pipe and a high initial steam pressure, the studies suggested the possibility of distributing steam at relatively high pressures over greater distances than are now customarily used but showed that as the distance increases the heat lost from the lines becomes a quantity of such magnitude that it is definitely one of the limiting factors in long distance steam transmission.

Ground temperatures adjacent to buried insulated steam lines have been studied in but few instances. The committee also presented data on this subject collected from an installation where there are a 16-in., a 14-in., and a 4-in. steam pipe. These incomplete tests showed that the heat liberated from the larger line affected the soil temperatures to a greater extent and for a greater distance than in the case of the smaller pipe size.

Steam Jet Coolers

At the same session the research committee under the chairmanship of G. K. Saurwein, Harvard University, presented papers on Distribution Losses and Improving the Performance of Steam Jet Coolers. The study of distribution losses was undertaken to learn what is being done currently to ascertain the source of distribution losses other than those occurring in the distribution system and to reduce these losses so far as possible. The collected data from a few cities showed that metering losses are frequently high.

The author of the paper on Improving the Performance of Steam Jet Coolers, Charles Hull, New York, stated that economies in one such plant had been obtained principally through the development of new control methods which allowed the theoretical performance of the machine to be obtained in practice.

Under the auspices of the research committee also was the description of an instrument developed for measuring small degrees of steam superheat, and called The Enthalmometer by A. A. Markson, New York, author of the description furnished to the committee. This instrument consists of pressure gages so arranged that their readings give a direct indication of the amount of superheat in steam flowing past the gages.

To conclude the papers presented by the research committee was one by Gilbert A. Kelley, Surface Combustion Corporation, which described the Kathabar system for using lithium chloride for air conditioning.

As the final feature of this lengthy first session the meters and accessories committee, W. W. Stevenson, Pittsburgh, chairman, presented a series of three papers as its report for the year. One, by Charles Pohlig, St. Louis, described a demand attachment for use with a shunt meter; another, prepared by E. A. Lueky and A. S. Griswold, Detroit, included test data obtained on a new type meter, while Mr. Stevenson presented for consideration a tentative steam meter specification. It listed 10 points to be considered in such a specification but aimed to provide necessary latitude for further improvements in meters.

Hot Water Heating

Opening the first evening session was the report of the hot water committee, prepared under the direction of A. W. Wieters, Toledo. To start the report D. W. Loucks, Pittsburgh, described how a year-round air conditioning system using water as the heating medium was installed in a large Pittsburgh building. Then a paper was presented by C. L. Johnson, Toledo, on the Present Status of Heat Unit Meters. Mr. Johnson's paper listed four meters now available for measuring the heat content of water passing the meter rather than the quantity of the water flowing. Two of these meters are of American manufacture, one was developed in Winnipeg, and one is of European origin. C. R. Wilson, Boston, told of some of the problems encountered when a hot water heating installation in the Suffolk County Courthouse in Boston was adapted to district steam service. The installation contained some of the original equipment put into service in 1884 and had thus been in use for over 50 years. The gravity circulation piping reached large sizes and in one part of the installation had a diameter of 36 in. It was adapted to steam by the use of heat exchangers in 1936. Much of the original metal showed but little deterioration in spite of its long period of use.

To close the evening session came the report of the operating statistics committee, Arthur D. Leach, Portland, Oreg., chairman. Reporting companies showed an increase in steam sales of nearly 6% for 1936 over 1935, and an increase in unit revenue of over 1%, while invested capital was reported at $109,000,000 by 30 reporting companies. It was also indicated that during 1937 twenty reporting companies were proposing to spend nearly $2,000,000 for capital purposes.

Plant Engineering

Three papers were included in the report of the steam station engineering committee whose chairman is A. R. Mumford, New York, and which was the first item of business at the Wednesday morning session. George C. Eaton, Boston, described some of the problems encountered in changing a plant from hand-fired coal to automatic heavy oil. The committee members prepared and submitted a series of short comments and sketches reparding their experiences in many phases of plant operation. Harold Farmer, Philadelphia, described apparatus for feeding concentrated acid to boiler feedwater. Included also in the committee report was a brief statement regarding Modern Power Plant Piping, by E. A. Kerbey, who reviewed recent trends in a few sentences. He stated: "The immediate past has witnessed a complete revolution in power plant piping design and general appearance. With the development of high pressure, high temperature, high rating units in both boilers and turbines, the power plant scene has changed to a major extent. Where once numberless boilers stood row on row, we now find one monster. Where once we saw numberless boiler leads struggling in order to get into the same header, we now seldom see any header at all. We find a comparatively small line leading directly from boiler superheat to turbine.

"This evolution has been sad from the piping fabricator's standpoint in that the number of pieces involved has been cut to a minimum. It has, however, accomplished much in forcing research and the development of studied technique in this industry. The results have been most gratifying in bringing about trouble-free operation. Minimizing the number of pieces involved in a piping system has minimized the possibility of shutdown due to failure of this important link between boiler and turbine. The system is now fabricated in the longest sections possible, within the limits of transportation and handling. This has resulted in a greater

part of the whole being done in the fabricating shop and fewer field joints. Welding fittings are fast taking the place of case flanged fittings. Looking into the future, it is not hard to visualize valves also being fabricated from pipe material by welding and made an integral part of shop fabrication.

"The advantages of higher pressures and temperatures have long been recognized; their application, however, has been retarded by the lack of proper materials and methods. Progress in materials has been rapid recently, but much still remains to be done in the way of standardization. A few short years ago the thought of tying a monstrous turbine to a single boiler was considered fantastic. We see them being constructed in every section of the country now. We hear such predictions as 96% expected availability from these units—now—and judging from recent strides in the art of power plant design, who dares question the judgment of those engineers making plans accordingly—now?

"Until the publication of the ASA Code for Pressure Piping in 1935, the writing of specifications for piping systems was an extremely haphazard task. It must be most gratifying to those individuals who helped prepare this Code to note how universally it is being used today. While its primary purpose is to provide a safe piping system, still it is fulfilling a definite requirement in standardizing piping methods.

"Perhaps the greatest criticism has been that the Code is too lenient in a lot of respects and has not been definite enough in other respects; still it must be acknowledged as providing the foundation for a future Code which will more nearly fulfill future requirements. Its introduction closes with an invitation which reads . . . 'the committee . . . will give full consideration to suggestions for changes and additions.' It, therefore, behooves every engineer interested in this subject, who believes that a Code of this type is of value for better design and greater safety, to carefully study its contents and submit to the committee constructive suggestions."

Mr. Kerbey included a statement regarding the method incorporated in the Code for determining the wall thickness of pipe up to 850F and a table showing the commercial wall thicknesses of pipe now available. Increasingly high temperatures make the extension of data to temperatures above 850F desirable and he presented suggested data up to 1200F together with an example showing its application. He felt that the Code should be revised in important particulars so far as welding practice is concerned, but that "Welding is doing away with a vast number of flanged joints resulting, thereby, in better appearance of the finished system and at the same time increasing the safety of the system. The acceptance and application of welding also make for easy future changes with a minimum of effort.

"Considerable study has been given to the necessity and design of reinforcing of nozzle welds. It is generally conceded that when the nozzle size is one-half or smaller than the header size, reinforcing is unnecessary. A series of destructive tests is now being conducted to determine definitely the amount of reinforcing necessary to compensate for the strength lost by cutting nozzle openings in the header. It is hoped that this information will bring about Code coverage on this important item.

"Modern power plant steam temperatures have made designers expansion conscious. With the use of elevated temperatures, more consideration is being given to the creep qualities of the materials used. Present practice is to make a thorough study of the location of rigid anchor points and then make provision for the lines to move freely between anchors in whatever direction they will, without restraint. Welding has made possible the simplification of design. Under studied procedures, providing the procedures are strictly enforced in the actual work, there should be no fear of the quality of work produced. Future changes are easily accomplished by means of welding. The elimination of flanged joints makes for greater safety and better appearance, as well as materially reducing cost of insulation."

Chemistry Committee

As a major part of the report of the chemistry committee (Harold Farmer, Philadelphia, chairman), Louis Shnidman presented an extended statement of the present means of determining steam purity. He showed sampling methods and apparatus together with methods which may be followed in analyzing the

Among the new officers of the National District Heating Association are: James R. McCausland, first vice-president; Glen D. Winans, second vice-president; Melvin D. Engle and F. L. Witsell, members of the executive committee.

samples and discussed these as limitations surrounding the determination of steam purity. Harold Farmer described methods in use in pretreating coal in order to prevent slag formation on boiler tubes. He considered sodium chloride treatment as one method, calcium chloride treatment as another, and the addition of a catalyst as a third. He concluded that the present information is not convincing that "pretreatment of coal for the prevention of slag formation has advanced to the point where it is of any real commercial value in connection with burning coal in large industrial boilers. There is some evidence that intelligent study of all the conditions involved may develop some satisfactory means for improving the slagging qualities of the low grade coals. Successful treatment of low grade fuels would be of great value for plants located in low grade fuel districts and would justify reasonable cost for treatment by reason of the reflected economy in freight cost."

Training Salesmen

So important have become the problems of sales promotion and commercial relations that the entire session on Thursday morning dealt with these subjects. Featuring the report of the sales development committee, R. J. J. Tennant, Pittsburgh, chairman, were statements regarding the course of study for salesmen underwritten by the association and conducted by Sales Analysis Institute. The course was well attended and those present were enthusiastic about the results produced. Don E. Griffin outlined the aims and methods of the Institute while Earl J. Seiter, Baltimore, reported his impressions of its value. St. Elmo Lewis, long identified with improved selling methods and sales training, delivered an inspiring address on the importance of recognizing the sales problem and evaluating it properly in the light of our present conditions. R. D. Martin, New York, presented a paper on New Applications for Central Stations' Steam Service, and Vernon Alley, Philadelphia, described the plan devised for increasing steam sales in that city.

Principles of Economical Heating

In introducing the subject matter gathered by the commercial relations committee, Leonard S. Phillips, chairman, New York, stated that he regarded the revised edition of the booklet, Principles of Economical Heating, as the most noteworthy result of the committee's efforts. These efforts extended over a two-year period and with the sale of nearly 4000 copies of the booklet since its appearance in January, he felt that the work involved was well worth while.

As another feature of the committee's work F. Lee Rapson presented a series of eight cases reported by members where customer utilization work had been carried on to advantage. These cases were typical of current results obtained from such work and included a large office building where zoning was undertaken; a steam jet refrigeration job installed in a new building and where close cooperation with the operating staff, some changes in equipment details and the development and installation of an operating control brought about a 43% reduction in the amount of steam used. In another case a close study of the heating system and its operation showed a reduction of 46.7% in the steam required for heating when the heating system was modernized, new traps installed, and a new control added. Again, a printing shop showed important savings when properly trapped, radiator sizes adjusted, and separation of mains carried out to permit short hour heating when possible. Installation of insulation on the roof of a loosely constructed building resulted in a 30% reduction in the steam used and permitted the whole cost of the insulation to be credited during the first year's operation. Such case material strengthens the conviction that utilization work among customers is of the utmost importance in promoting good commercial relations.

Albert H. Fry, Chicago, described the Whitenack system of heat control in which control of operation is secured on a volumetric basis. He stated that installations of this method have been made in three cases in Chicago and in 14 buildings in New York but that conclusions were not possible although indications are that substantial savings are being realized.

District Steam's Future

In his paper, A Future in Steam, Robert L. Fitzgerald, Duluth, presented a strong case showing that central station steam has been handicapped in its progress by a bad early record and that now the causes of the early failures are well known and need not be repeated. He went on to show that such projects should shortly be readily financed and painted a picture of the relative positions of gas, oil, and central station steam as regards the investments necessary, the operating costs, and the revenues realizable from plants of each kind necessary to supply heat to urban territories. He concluded that steam as a public service to supply heat has attractive possibilities and pleaded that concentrated attention be devoted to these possibilities.

The committee also included in its report samples of talks given by members before engineer groups and over the radio as examples of what could be done by such methods in promoting good commercial relations.

At the closing session of the convention on Friday morning the report of the rates and regulations committee was presented briefly by the chairman, J. M. Arthur, Jr., Kansas City, and was followed by a statement by Wm. H. Sanford, secretary-treasurer, regarding the bulletin of the association. The election and installation of officers brought the convention to a close.

Exhibits

Throughout the week an exhibit of equipment was held in connection with the convention where the following firms had arrayed highly interesting displays of their products and activities: American District Steam Co.; American Society of Heating and Ventilating Engineers; E. B. Badger & Sons Co.; The Bristol Co.; Central Station Steam Co.; Cochrane Corp.; Crane Co.; C. A. Dunham Co.; Ehret Magnesia Manufacturing Co.; Electronic Control Corp.; HEATING & VENTILATING; Johnson Service Co.; Marsh Tritrol Co., Minneapolis-Honeywell Regulator Co.; The Ric-wiL Co.; Spence Engineering Co.. Inc.; H. O. Trerice Co.; Warren Webster & Co., and Wright Austin Co.

London's First Air Conditioned Apartment

EATON HOUSE, the first entirely air conditioned apartment house in London, is an eight-floor building of luxury apartments with yearly rents ranging from $2075 to $6250. It is natural in such a building for each individual tenant to have his own ideas on what constitutes a healthy atmosphere, and for this reason a centralized air conditioning plant was impracticable. An alternative was to install separate air conditioners in each apartment with cooling taken from a central water-cooling system in the basement. However, this plan was ultimately dropped because of the great amount of piping required to feed the coolers and the necessity of a continuously running pump. Therefore it was finally decided that each apartment should be equipped with its own entirely independent air conditioner, and 30 such units were installed.

The plant in each apartment consists of a condensing unit working with a vertical air conditioner, which comprises a slow-speed fan and motor, heating coil, cooling and dehumidifying coils, air filter, and winter humidifying spray. The air conditioners, each of which occupies 3 ft. by 2 ft. of floor space, are installed in the kitchen of each apartment. There are two large areas in the center of the building, built for light wells and to house the escape staircase. The condensing units are installed in these areas, each unit being adjacent to the apartment served.

Each conditioner handles 1300 c.f.m. of air, representing about 12 changes of air per hour throughout each apartment of five or six rooms. In the hottest summer months there is a drop in temperature between the outside and inside air of 8F, with an appropriate reduction of the humidity. Each conditioner obtains its hot water from a central supply, which also serves the hot water requirements of the apartments and heats the stairways and corridors.

The controls are located on an instrument board in the hall of each apartment. They consist of a thermostat, humidistat, and a change-over rotary switch from heating to cooling, and vice versa. When, as frequently happens in the early summer and fall, cooling has been necessary during the day and the evenings bring a substantial fall in temperature, the tenant can, by turning the rotary switch from cooling to heating and setting the thermostats at the desired point, cut out the compressor and open the automatic hot water valve. It is unnecessary to have this done by a serviceman, as, owing to the arrangement of the installation, the refrigerant in the evaporator is not affected by the heat from the heating coil when the latter is in operation.

The hot water supplies are provided by three gravity feed boilers, automatically fired with coke. The entire fuel supply for each boiler, consisting of 2-in. graded coke, is stored in two side magazines, and each boiler will hold sufficient coke for 18 hr.

A special problem which this installation provided was that of air distribution in the apartments as, owing to the severe restriction on the height of buildings in London, it was impossible to install false ceilings and to entirely conceal the ductwork. However, an ingenious method of overcoming this problem was found. An air delivery duct is carried from each conditioner at high level with branches to each room. Use was made wherever possible of the cupboards and service space to house the ducts, and where this was impossible the ducts were designed and treated with expanded metal and plaster to represent beams. The ductwork is designed on low velocities and sound absorbent baffles were fitted where required. Each branch terminates in a diffuser grille at high level in the room. The return air is taken from the hall of each apartment, grilles being fitted at low level in each of the rooms so that no direct ductwork connection is needed and the maximum floor space is preserved.

(Left) One of the light wells showing the installation of condensing units on special platforms of the fire-escape. (Right) Typical bedroom. Supply registers are shown above the bed and circulating register at the side of the closet.

Three speakers at the warm air convention: (Left) F. H. Ramage, Cleveland; (Center) J. A. Rodgers, St. Louis; (Right) D. O. Price, Toronto, Canada.

Research and Code Features of Warm Air Convention

A NUMBER of papers of outstanding interest were presented at the mid-year convention of the National Warm Air Heating and Air Conditioning Association which was held at the Hotel Cleveland in Cleveland, Ohio, on June 8-10. The subject matter of the papers was of a wide variety and covered such information as the balancing of warm air systems, the new Technical Mechanical Code, electric motor design and installation, speed control systems for fan operation, humidity problems, and merchandising warm air products. Over 350 men were gathered in the convention hall to hear and discuss the various papers.

In the opening address on Tuesday morning President Rybolt stated that the problem facing warm air manufacturers was not one of sales but of adjustment to meet the problems of increasing costs and normal production; that is, problems brought about by legislation, industrial disputes, and other problems beyond the warm air manufacturers' control. With regard to price setting, President Rybolt had this to say: "There will always be arguments with reference to price setting but this is absolutely an individual proposition, something for each and everyone to figure out for himself, and it is not now, nor never will be, an Association matter."

A. O. Eberhart, former governor of Minnesota and now Special Assistant to the Administrator of the Federal Housing Administration, spoke of his organization's efforts to provide homes for workers with low incomes, while K. W. Cash of Des Moines, Ia., substituting for Nelson B. Delavan, discussed the merchandising of warm air products.

Balancing Warm Air Systems

One of the most important steps in the installation of a winter air conditioning system is the balancing of the air flow in the various ducts to give the proper distribution and air temperature in the various rooms. D. O. Price of Toronto, Canada, gave an excellent talk on this subject. He first described the two methods of balancing—by temperature and by air flow. While the balancing by the air flow method can be done at any time of the year, Mr. Price stated that he prefers the temperature method even though its use is limited to fairly cold days. He has found that the temperature method requires a minimum amount of time and results in a much more even temperature in the rooms. He also discussed the equipment necessary for temperature balancing and gave an excellent detailed outline of the method of procedure.

Humidity

Also presented during the Wednesday morning session was a talk by Prof. L. G. Miller of Michigan State College on humidity and the problems incident thereto. One interesting point mentioned by Professor Miller was the problem of protecting the covering of cold water and brine pipes and tanks. Due to the temperature differential there is almost a constant driving vapor pressure from the surrounding space towards the cold surface of the pipe or tank. Unlike building construction where the vapor may escape into other spaces it is faced with an almost impenetrable steel wall. The small amount of space becomes saturated, the cold water or brine carries away the heat of condensation and the insulation becomes filled with condensation thereby losing its character. The obvious solution is a vapor-proof casing around the insulation, always remembering that bands or plastic tops while being quite waterproof are not vapor-proof.

Research Report

Except for a brief report of the research advisory committee by F. G. Sedgwick, the committee chairman, the entire session on Wednesday afternoon was taken up by the reports of A. P. Kratz and S. Konzo of the University of Illinois on the investigation conducted at the research residence. Professor Kratz's talk was entitled "Results of the Investigation of Summer Cooling in the Research Residence" and was devoted mainly to

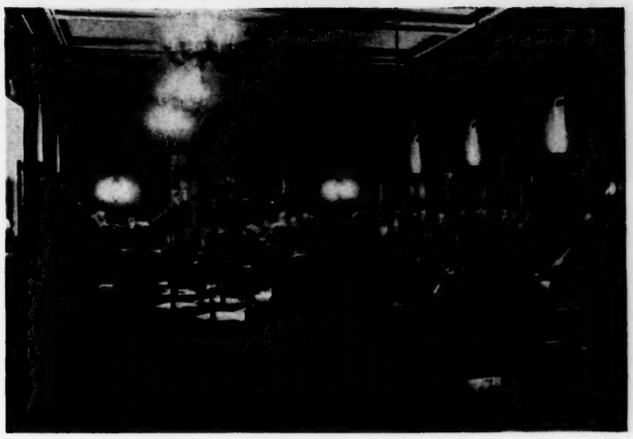
a discussion of the findings as reported in the Engineering Experiment Station Bulletin No. 290. Mr. Konzo gave a report of progress of the research investigation. His talk dealt with the results of tests on a two-speed control system for fan operation. The results of this investigation will be reported in an Engineering Experiment Station Bulletin in the near future.

Mechanical Warm Air Code

On Thursday morning Prof. J. D. Hoffman of Purdue University, who is the chairman of the installation codes committee, gave a short talk on the New Technical Mechanical Installation Code which was recently published by the association. In discussing the Code, Professor Hoffman stated that it is submitted not as a finished piece of work but rather as representing the best united judgment at the time. Worthy suggestions will be, and in fact already have been made looking toward its betterment. "In the development of the first edition of the Code," he continued, "we have tried to avoid a radical demand. If it errs in any part where more than one interpretation could be used, we prefer to have it not so rigid or so exacting as to eliminate good individual practice. The experience of many users always smooths out the wrinkles of uncertainty." Professor Hoffman then introduced two members of the committee, Fred R. Bishop and B. F. McLouth, who discussed the Code in detail and illustrated its use with a typical example.

Electric Motors

The last paper of the meeting was presented by J. A. Rodgers, St. Louis, and was entitled "Electric Motor Design and Application for Our Installation." Mr. Rodgers gave one of the best discussions of electric motors for use with fans, blowers, and refrigerating equipment which has appeared to date. His paper was divided into two parts, the first taking up the motors with usual fan blowers and similar fan equipment, while the second discussed the motor application to compression equipment as would be required for gas compression for refrigeration purposes. He pointed out that one of the most serious problems encountered by motor manufacturers is the one resulting from the blower manufacturer supplying a motor complete with a multi-step pulley or, what is worse, with a recommendation that for change in air delivery a different pulley and belt combination be supplied. According to Mr. Rodgers, the general result of this is that if the installer after completing the application finds insufficient air delivery he is likely to go to some supplier, get a new belt and pulley combination or use one of the pulleys supplied and obtain a smaller or larger one for the other, thus raising the speed of his blower. He entirely overlooks the fact that the required input to the blower will increase as the third power of the speed; the result being that the motor is seriously overloaded, probably never gets off its starting winding and, of course, ultimately burns out. Mr. Rodgers urged that everyone become thoroughly familiar with the rapid increase in power demand which results from changes in blower speeds so as to be able to properly calculate the result of speed changes.



Thursday morning session of the convention.

Entertainment

The social portion of the convention was not nearly the success that the technical portion was. On Wednesday evening there was scheduled a visit to the Great Lakes Exhibition and a dinner and the show at the Marine Theatre-Restaurant where the Aquacade was to be presented. Dinner was served but due to a very bad rainstorm it was impossible to present the Aquacade. Because of the rain most of the visitors found it impossible to inspect the exhibition.

(Left) President W. L. Rybolt giving his opening address; (Center) Vice-president C. A. Olsen, chairman of the afternoon session; (Right) Prof. L. G. Miller of Michigan State College, who spoke on Humidity.

ENGINEERING NOTEBOOK

Water Hammer in Pipes

In a paper before the Institution of Mechanical Engineers (Great Britain) entitled "Water Hammer in Pipes, including those supplied by centrifugal pumps: graphical treatment," Robert W. Angus summarizes his views as follows:

The damage done to pipes as a result of water hammer is so serious that no engineer can afford to neglect it in the design of long pipes, particularly those under low heads. Unfortunately, the problem has appeared to many to be very intricate, and indeed the mathematical treatment is so involved and so lengthy that few practicing engineers would attempt to solve water-hammer problems mathematically. In many cases a purely arbitrary rule has been employed in finding the pressure rise, with little knowledge on the part of the engineer as to whether the formula fits his case or not, and thus much money may be wasted on too heavy a line, or, on the other hand, it may be so light as to be dangerous.

In the treatment of the subject given by Professor Angus in his paper the rigid theory has first been explained and some problems have been solved, but most of the paper deals with the elastic (and correct) theory. A problem is first worked out by the arithmetical integration method in order to establish ideas and to make the subsequent argument clear. The fundamental equations giving rise to Allievi's equations must be clearly understood for a grasp of the true relationships that exist, and these have been treated in some detail, but it is safe to say that if the argument has been followed up to the end of the general equations, no difficulty will be experienced with the graphical treatment.

In explaining the diagrams, very simple cases are first dealt with and the elegance of the method will make an appeal at once. The water-hammer pressure can be found for any simple pipe, and at any point on the pipe, and for any chosen gate movement, and results can be obtained with accuracy in less than thirty minutes in simple cases. For compound pipes, the solutions are nearly as rapid. The pressures arising in the discharge lines from pumps have been fully discussed in the case of pumps with small inertia, and also in cases in which the inertia is large enough for consideration, when an existing pump has been employed to supply the data used.

The accuracy of the method is said to be beyond question.—*Mechanical Engineering.*

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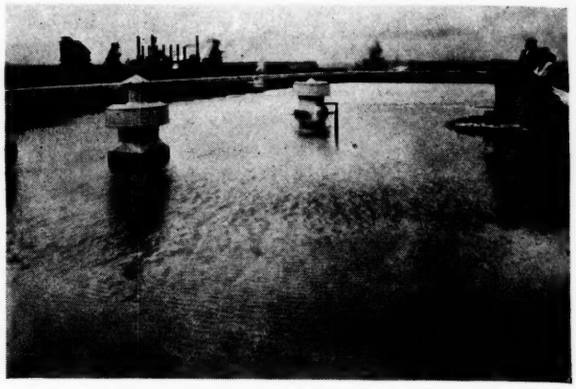
Air Conditioning Costs Cut by Water Insulation

Water insulation is made use of in the air conditioning of the research laboratory of Swann & Co., Birmingham, Ala. Theodore Swann is president of this company.

The flat roof of the two-story building is kept constantly covered with water two or three inches deep. Acting like a wet cloth around a water jug, the water helps to keep the second story cool during the summer. In the winter the water or ice is said to act as a blanket to help keep in the heat. During certain seasons of the year rain water is sufficient to keep the roof covered, and any surplus drains off through overflow pipes. At other times water is pumped onto the roof from the company's well.



Water insulation on the roof of research laboratory in Birmingham.

With the water insulation, an air conditioning plant of only 10 tons was considered adequate for the second floor, which is given over largely to laboratory research and a library. Refrigerated water used in plant processes is also utilized for air conditioning purposes. Automatic gas heat, humidification and filtration are provided in winter.

The first floor of the laboratory, given over largely to offices, has a 20-ton air conditioning system which is entirely separate from the second floor system.

Engineers estimate that the roof pool results in a saving of 25% on equipment costs and 25% in electrical operating costs. While no exact computations have been made at the Swann plant these figures are believed to be approximately correct.

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The Need for Fuel Engineers

The importance of fuel engineering for some strange reason has been underestimated in the United States. It is lamentable, but true, that the bulk of the coal tonnage in this country is being consumed with but little regard for good fuel engineering practice. Much confusion and unnecessary expense could be avoided were there greater appreciation of the many variables involved in the selection and application of coals.

Coal is perhaps the most complex mineral with which man has to deal. Thiessen says: "Coal is a complex substance, consisting of many different constituents, representing many chemical compounds, very few of which are known."

Coal occurs in great variety. There are several hundred different seams involved. All coals differ in some degree. This applies even to coals from the same seam

which may vary widely from one district to another in the same field, and sometimes noticeably in the same district.

When the question—"What are good coals and what are poor coals?"—arises, one with little experience is likely to classify coals as being good or poor according to their analytical value, calling those of high heat and low ash content, good, and those having opposite qualities, poor coal. In other words, it might be said that they refer to the apparent scientific value of coal. However, particularly in combustion practice, this basis does not necessarily hold. If one works long enough with a large variety of coals, he will at some time hear the so-rated best coals condemned and the poorest praised. Why is this so? It is because practically every coal has some outstanding virtue. Coals of low analytical value sometimes may be redeemed by certain other properties when used in certain equipment and under specific conditions. Some coals are flashy (fast igniting and fast burning); others ignite and burn slowly. This is irrespective of heat value; in fact, coals of lower heat value tend to be flashy.

To illustrate, engineers often find cases of hard-worked boilers equipped with stokers having limited live grate area. Much of this equipment is of old vintage. If these units are using standard screenings, for example, the flashy type coals may carry the load better than other coals, even though the latter are of higher heat value. In such instances, it is not a question of the heat value of the coal, or how much water a pound of coal will evaporate, but instead is a matter of the rate or speed of heat liberation. In other words, how fast can the coal release its heat units?

The experienced engineer makes a distinction between the scientific value and the use value of coals, and in the end, if these two values differ, he casts his lot on the side of the use value. It should be mentioned here that the fuel engineer has several means at his disposal for improving the use value of a given coal.

The number of full-time fuel engineers in this country is very small and inadequate. There being poor definition and no census, it is difficult to tell how many such engineers are engaged by all industries and agencies interested in fuels. Several reliable sources have estimated the number of fuel engineers to be around 300. Of this number, there are perhaps not over 100 engaged in the direct application of coals. The others are accounted for by the gas and oil industries and various public and private research agencies. It is interesting to consider this small number of engineers in relation to the bituminous coal tonnage.

In 1936, the production was 434,070,000 tons. Dividing this figure by the number of engineers directly engaged in coal application (estimated at 100), it is found that the proportion is one fuel engineer for approximately 4,350,000 tons. It is obvious that one man cannot adequately supervise the application and use of such a tremendous tonnage. A monetary comparison also is helpful here. The delivered value of this tonnage, including f.o.b. mine price and railroad freight ($1.77 plus $2.25 per ton, respectively, or a total of $4.02) was approximately $1,750,000,000. This indicates that there is one engineer for every $17,500,000 worth of product. A rough calculation reveals that for every dollar invested in this type of fuel engineering, $3500 or more is spent for the product.

These figures are only approximate and cannot be readily substantiated. Possibly, they should not be used with such great abandon. Also, it is hoped no one will get the impression that these few fuel engineers represent the only technical supervision over this gigantic tonnage, for it is true that engineers in other capacities give some attention to fuels. However questionable the figures may be, they at least serve to focus attention on the fact that very few engineers give their undivided attention to the proper utilization of coals.

It is almost unbelievable that a product such as coal, having an annual gross value of about two billion dollars and requiring close technical supervision in its proper use, should be merchandised and consumed year after year without the benefit of more technical supervision.—*Abstracted from an address by J. E. Tobey, manager, fuel engineering division, Appalachian Coals, Inc., made April 13, 1937, at Institute on Coal Utilization, Ann Arbor, Mich.*

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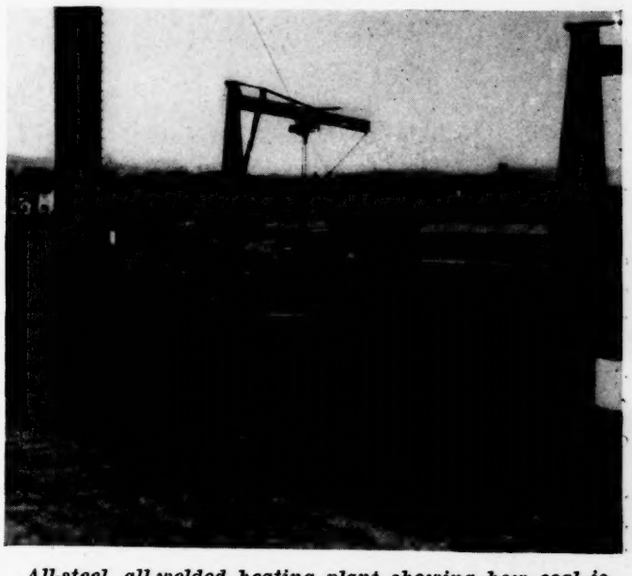
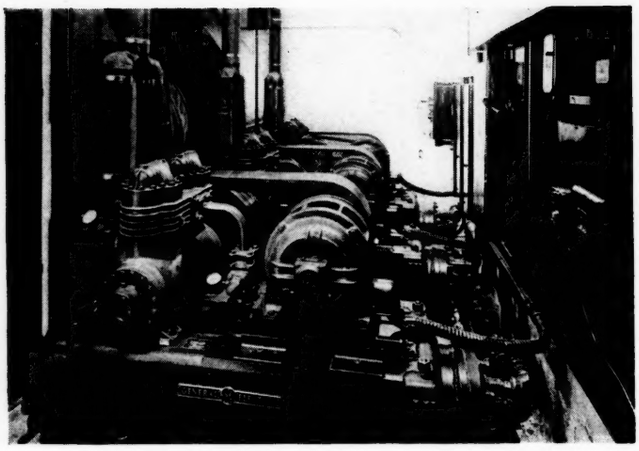
Heating Plant Has Coal Delivered Through Roof

The Peoria factory of R. G. LeTourneau Inc., manufacturer of heavy grading equipment, is heated with an unusual heating plant. The plant is all-steel, all-welded structure with a welded stack 104 ft. high. The dimensions of plant are 40 × 40 × 21 ft. high, approximately 8 ft. of which are below the ground. An earth ramp is built from the ground level to the roof of the structure so that coal trucks may drive up on the roof and dump their loads into the 100-ton bunkers. From these bunkers, 16 × 40 × 7 ft. high, the coal is fed by gravity through automatic stokers. These stokers fire two fire-tube boilers which develop approximately 500 hp. each. The factory which is heated by this unusual plant is 1200 ft. long, 160 ft. wide for 900 ft. of this length, and 100 ft. for the other 300 ft.



All-steel, all-welded heating plant showing how coal is delivered through the roof. Jib crane in foreground is used to hoist out the ash.



Modern condensing units in Miami theater.

Antiquated 125-Hp. Compressor Replaced with Three 20-Hp. Units

Modernization of the air conditioning facilities at the Capitol Theater, Miami, Fla., was substituted several months ago for reconditioning of the existing plant—a practice that was annually becoming a greater burden upon the management—and has resulted in gratifying results to date, according to Mitchell Wolfson, executive director of the Miami Wometco Theaters. After an engineering survey, three 20-hp. condensing units, automatically and thermostatically controlled, were installed in place of an antiquated 125-hp. unit. Six months of more efficient and more economical operation have indicated that the new plant will more than pay for itself within a few years.

The previous carbon dioxide plant, requiring the services of an engineer and an assistant, was habitually torn down and reconditioned annually before the advent of summer weather. Material, labor, and parts were increasingly hard to get.

General Air Conditioning Corporation designed and installed the new system, which consists of the three 20-hp. condensing units, two air conditioners, and new distribution outlets. The entire air distribution system was altered to conform with standard requirements. The three new units were located on the site of the condenser previously used, and were built into the machines at the factory. This resulted in a compact, easily controlled installation. Condenser cooling water was obtained from an existing well. Since the water was known to have a bad corrosive action, and to save the cost of a water softener, the condensers were built of corrosion-resisting material. The two factory-built conditioners were arranged to operate as a single 66-ton unit, and were installed in the equipment room.

One of the chief advantages of the new system is that during the slow periods of the day, when only a few people are in the theater, a single 20-hp. unit will carry the load formerly carried by the 125-hp. unit.

An automatic ventilation air control has been provided to effect economy. On cool days it calls for more ventilating air and less refrigeration, while on extremely hot days it reduces the amount of outdoor air to permit a smaller installed capacity to accommodate the occasional peak load.

British Bill Provides for Factory Heating and Ventilating

Provisions of the new British Factories Bill relating to the efficient heating and ventilation of factory workrooms have recently been considered by a Standing Committee of the House of Commons, and the clauses relating to these provisions have been agreed upon.

In Clause 2, which provides that a factory shall be regarded as overcrowded if the workpeople have less than 400 cu. ft. of air space each, Ellis Smith moved an amendment that the proviso in the Bill, that for five years the figure should be 250 cu. ft. and should afterwards continue at the lower figure where a workroom has effective mechanical ventilation, should not apply when overtime was being worked. Mr. Smith said that many of the inspectors had very large areas and it might be years before they got round to inspect all the premises in their area. The standards they were aiming at setting up in the Bill should, he contended, be national standards.

Sir John Simon, Home Secretary, said there was a practical difficulty in making one rule for overcrowding before overtime and a different rule when overtime began. He said the form of the proviso should be modified, for it made possible an indefinite prolongation of the less satisfactory standard of cubic space.

Mr. Smith then withdrew his amendment and Sir John Simon moved an amendment to restrict the reference to five years in the proviso to factories which had been continuously in the same occupation since the date of the passing of the Bill into law. This amendment was agreed to.

Sir John then moved another amendment to alter part of the proviso and enact, among other things, that where effective and suitable mechanical ventilation was not provided the proviso should not continue to apply, although the five years had not expired. This amendment was also agreed to.

Clause 3, which provides that effective provision shall be made for maintaining a reasonable temperature in each workroom, but that there should be no escape into the air of fumes likely to be offensive or injurious, was approved.

Geoffrey Mander moved an amendment to delete the words "is done sitting" in the sub-clause which provides that in workrooms in which much of the work is done sitting and does not involve serious physical effort, a temperature of less than 60F should not be deemed, after the first hour, to be reasonable. Mr. Mander said that the phrase "is done sitting" might be a temptation to a few employers not to provide seats.

After discussion on the subject, Sir John Simon said he would have the subject further considered, and the amendment was withdrawn.

Clause 4, which provides that there should be effective provision for securing that a workroom is adequately ventilated and for rendering harmless, so far as practicable, fumes, dust, and other impurities, general in the cause of work, was approved with minor amendments.

The Committee has nearly completed its consideration of the Bill, which will then be submitted to Parliament for passage into law.

ABSTRACTS of Current Papers, Books and Pamphlets

Electric Motors and Controls

Heating, ventilating and air conditioning engineers and contractors are constantly dealing with the application of electric motors to various pieces of equipment such as fans, compressors and pumps. They are not particularly interested in the design or construction of the motor but they are interested in what the motor will do and the methods of controlling them.

Because of this specialized interest there is much of interest to them in this book. It is the author's purpose not to deal with details of motor design but to present in a form as concise as possible the characteristics that are obtainable from the various types of motors and the performances that may be secured from them by the selection of suitable controls.

Classification and terminology applying to both motors and controls have been governed by the standards established by the National Electrical Manufacturers Association. A list of some of the chapter headings follows: Determination of Machine Requirements; Direct-Current Motors; Direct-Current Control; Squirrel-Cage Induction Motors; Wound-Rotor Induction Motors; Synchronous Motors; Single-Phase Motors; Multi-Speed Motors; Protective Control Devices; Control Accessories; Stopping Devices; Motors for Quiet Operation; General Motor Enclosures; Motor and Controller Enclosures: for Hazardous Conditions; High-Frequency Induction Motors; Shaftless Motors; Integral Speed Reducers; Connecting the Motor to Its Work; Fan and Blower Applications; Pump and Compressor Applications; and Miscellaneous Applications.

[*"Motor and Control Applications," by George H. Hall. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York. Cloth bound; 6 x 9 in.; 259 pages; price, $3.*]

Degree-Day Handbook for Checking Heating Plant Operation and Predicting Fuel Consumption

In order to consolidate the considerable amount of degree-day data which has been accumulated over a period of years and in order to present in compact and usable form complete information on the applications and derivation of the degree-day unit, HEATING & VENTILATING has published its new Degree-Day Handbook. This book is useful both to the operating engineer as a guide to operating efficiency of his plant, and to the designing engineer in estimating fuel consumptions of buildings.

In a 60-page table, figures showing the normal number of degree-days, by months, for 1064 cities are presented. These figures are based on averages covering periods from 10 to 50 years.

For the first time the actual number of degree-days by months in recent heating seasons (1927-36) for 54 large cities is available between the covers of one book. The book embodies also a new idea in determining the average temperature of the heating season by using the idea of the degree-day. This information, presented in a table covering 411 cities, gives not only the average temperature for the heating season but the length of the season in days, the beginning and ending dates of the heating season, together with recommended design temperatures, and record high and low temperatures.

The book contains 14 reference tables included in which are tables of degree-days for industrial heating, tables on the heating value of various fuels and fuel constants for predicting fuel consumption.

The second portion of the book is devoted to three chapters describing how use has been made of the degree-day. The first includes practical examples showing how various operating engineers have made use of the degree-day in industrial plants, commercial buildings, school buildings, and in district heating work. The second chapter covers customer relations work and sales promotion and illustrates by examples how the degree-day unit has been used to promote the sales of various fuels. The third of these chapters is entitled "Use of The Degree-Day in Market Research."

A chapter is devoted to telling how the base temperature of 65F was established, summarizing the work which has been done in checking the accuracy of the figure 65. This chapter is followed by one on use of the degree-day in predicting fuel consumption and explains the theory upon which the degree-day is based. It includes formulas showing how the degree-day was originally applied in predicting fuel consumption, and also contains an entirely new formula for predicting fuel consumption, the derivation of which explains how to predict fuel consumption even in southern climates in the United States.

The book closes with a useful chapter on summer cooling data for 18 cities. This includes a count of the actual number of hours that the dry bulb temperature was above 75F, 80F, 85F, 90F, 95F, and 100F for each of the summer months of the past five years for the 18 cities.

[*Degree-Day Handbook, by Clifford Strock and C. H. B. Hotchkiss; published by The Industrial Press, 148 Lafayette St., New York. 298 pages, 6 x 9 in., green semi-flexible binding, 29 tables; 27 illustrations, including a degree-day map of the United States. Price, $3.*]

Heating and Air Conditioning of Buildings

This is one of the best English books on heating and air conditioning which has appeared to date. It has been written by two men who are well known to the British heating trade. The basic material was originally published in The Architects' Journal and in this book the original material had been considerably amplified and many new sections added. As far as possible the authors have presented the material in a non-technical manner.

Because of the large amount of hot water heating in England the authors give a detailed discussion of this method. The chapter includes a number of tables and charts on such subjects as circulating pressure of water; water density at various temperatures; and flow of water to pipes. It also gives a detailed discussion of the sizing of hot water heating pipes, together with a number of practical examples. The chapter on heating by steam is handled in rather elementary though excellent manner. What this chapter is is a review of American steam heating practice because as the author states, this type of heating is not used much in England. The section on sizing steam pipes is well done.

Another chapter of interest is the one entitled Running Costs of Heating Systems. This chapter furnishes information to determine the operating costs of heating systems and auxiliaries. Included is a degree-day map of England as well as a number of tables giving heating costs of typical buildings. Some of the other chapters in the book are entitled: Considerations Affecting the Choice of Heating System; Boilers and Combustion; Oil Firing; Hot Water Supply; Heating and Hot Water Supply by Gas; Heating and Hot Water Supply by Electricity; Air Conditioning; and Electrical Generating Stations.

[*"Heating and Air-Conditioning of Buildings," by Oscar Faber and J. R. Kell. Published by The Architectural Press, 9 Queen Anne's Gate, Westminster, London, England. Cloth bound; 6 x 9 in.; 434 pages; price, 25 shillings.*]

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Statistics for the Construction Industry

Nearly twice as many people were employed by the contracting branch of the construction industry in August, 1935, as in February, according to the second of the series of final reports on various phases of the current census of construction.

The report, designated as Construction Volume II, is the second of a series of three presenting statistics collected by the Census of Business in 1936 by a canvass of general contractors, operative builders, and special trade contractors. Figures in considerable detail by kind of contracting business, and by states, cities and geographic divisions, show employment by months and by occupational classes. Fluctuations of employment in the construction industry are measured in the report through the use of four yardsticks: number of employes; number of wage earners at the site of construction; payrolls, and number of man-hours, all shown by months.

Total reporting establishments number 75,047, performing work valued at $1,622,862,000. Of this number, establishments reporting employment data are 46,429, employing 379,067 wage-earners.

Changes in employment are most pronounced in the case of general contractors engaged in highway construction, and show the least variation in the case of contractors engaged in glass and glazing. Detailed figures show that the fluctuations in employment are greater for the northern states than for the southern states. All data in the publication are classified by type of contractor reporting, including heating and piping contractors, heating and plumbing contractors, and plumbing contractors.

[*"Census of Business, 1935—Construction Industry, Vol. 11, Employment by Months, by Occupational Groups by States and Cities, and by Kinds of Business." Prepared by George J. Lawrence; published by the U. S. Department of Commerce. Standard size, offset-printed 164 pages. Limited number of copies available on request.*]

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Engineering Thermodynamics

This book sets forth the elementary essentials of the science of thermodynamics and is written primarily to serve as a textbook for students having a knowledge of chemistry, physics, and mathematics through calculus. Much material of a descriptive nature pertaining to engineering equipment has been omitted and the book deals mostly with the theoretical side of thermodynamics. A logical and concise outline has been used to give the student the principal steps in their proper working order of the development of this science.

The first eight chapters of the book are designed primarily to give the student a good foundation for the many applications of thermodynamics in the field of engineering. A few of these applications are discussed in the later chapters. A list of chapter headings follows: Thermodynamics and Energy; State of a Fluid and Changes of State; Energy Equations; Gas Properties and Processes; Cycles and Available Energy; Entropy; Vapor Properties and Processes; Gas Mixtures—Gas and Vapor Mixtures; Flow of Fluids; Vapor Power Cycles; Internal Combustion Cycles; Gas Compression; and Refrigeration Cycles.

[*"Engineering Thermodynamics," by Newton C. Ebaugh. Published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York. Cloth bound; 6 x 9 in.; 208 pages; Mollier chart inserted in back pocket; price, $2.85.*]

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Water Treatment and Purification

Water in its natural state is never found pure—there are always some chemical and sometimes physical impurities in it. Since under certain conditions and uses these foreign substances may be harmful, it is necessary to treat the water to remove them.

It is the purpose of this book to make available to engineers, plant managers, students, and technical men in general a description of the several purification and other processes that are applied to water. The construction and operation of the different types of filter-

ing, softening, and treating apparatus are described and illustrated by diagrams and photographs. The chemical reactions occurring in the treatments are also given. Because of the great importance of boiler feed water a relatively large amount of space is devoted to this subject.

In summarizing the available information on the various water treatments, the author has supplemented his knowledge which was gained in ten years' experience in the field, with a considerable amount of information contained in the transactions of engineering societies and the technical press. Since it is not possible to give complete details on every process, there is included at the end of each chapter a list of some of the more informative articles that have appeared in recent years in technical publications.

Among the subjects covered by this book are: the impurities in water; sedimentation and coagulation, filtration; analysis of water; the lime and soda-ash process; the Zeolite softener; boiler feed water treatment—methods used; disinfection of water; tastes and odors; and prevention of corrosion.

[*"Water Treatment and Purification," by William J. Ryan. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York. Cloth binding; 6 x 9 in.; 242 pages; price, $2.50.*]

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Natural Draft Ventilators

A report of tests conducted at the Anthracite Industries Laboratory to determine whether natural draft ventilators will correct adverse down drafts and improve chimney performance under normal conditions and varying wind velocities. Three types of ventilators were tested: (1) the syphonage type; (2) the revolving ventilator; and (3) the "tee" ventilator. All tests were run by a 12 x 12 in. brick chimney, approximately 30 ft. high, connected to a round sectional cast iron boiler having 1.52 sq. ft. area.

Results of these tests indicate that natural draft ventilators effectively correct adverse down draft air conditions. They do not, however, affect the draft of a normal chimney either by increasing draft or by reducing the available draft.

[*"Effect of Natural Draft Ventilators on Chimney Performance." Report No. 2260 of the Anthracite Industries Laboratory, Primos, Delaware Co., Pa. Paper cover; mimeographed; 8½ x 11 in. 11 pages.*]

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Chicago Heating, Ventilation and Refrigeration Ordinances

For the convenience of trade interests and for the purpose of aiding the transaction of public business, the Municipal Reference Library has reprinted in mimeographed form those sections of the Chicago Codes and Ordinances relating to heating, ventilation and refrigeration.

The information relating to heating has been taken from the revised Chicago Code of 1931 and includes the ordinances relating to the Department for the Inspection of Steam Boilers, Unfired Pressure Vessels and Cooling Plants; the Department of Smoke Inspection and Abatement; and covers chimneys, fuel oil burners, furnaces, gas water heaters, ovens and kilns, steam boiler erectors and repairers, stoves and ranges, temperature in buildings, gravity warm air heating plants, and miscellaneous heating apparatus. This publication includes all amendments up to and including April 16, 1937.

The publication on ventilation has been taken from the ordinances relating to ventilation and amended to March 1, 1937, while the publication on refrigeration contains all of the main sections of the revised Chicago Code relating to refrigeration together with the amendments up to and including October 1, 1936.

[*"Heating Ordinances of Chicago," 55 pages; 25c; "Ventilating Ordinances of Chicago," 64 pages; 25c; "Refrigeration Ordinances of Chicago," 12 pages; 10c. All publications mimeographed are on letter size paper and are available from the Municipal Reference Library, 1005 City Hall, Chicago, at the above prices; 5c additional postage for each publication.*]

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Forced Air Heating

Because of the increasing use of forced air heating and of the need for an up-to-date book on this subject, the second edition of Overton's "Forced Air Heating" has been prepared. Approximately 60% of the material is entirely new and is based upon facts established since the first edition was written. The new data cover design methods, resistances in equipment and pipes, temperature drop in ducts, air conditioning from a boiler, effect of new types of registers, return air systems and controls.

The chapters in the new edition have been arranged in the order in which the design problems must be considered. After heat loss in chapter 1, and three suggested design procedures in chapter 2, the chapters cover sizing of the apparatus; the problem of infiltration; location of registers and returns; advantages of multiple registers; return air systems, selecting register air temperatures; the problem of temperature drop in ducts; sizing ducts by the mechanical code and by the friction chart methods; engineering design of unusually long runs; pressure losses; velocities and how to select and control; proportioning losses throughout a typical system; branch takeoffs for friction reduction; volume dampers; bonnets and plenums; proper methods for baffling casings; chimneys and drafts; air conditioning radiator heated houses; automatic control for coal-fired systems.

[*"Forced Air Heating," by Platte Overton. Published by the Keeney Publishing Co., Chicago, Ill. Cloth bound; 6 x 9 in.; 215 pages; price, $2.*]

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Summer Cooling in the Warm Air Heating Research Residence

During the summer seasons of 1932, 1933, and 1934 a series of investigations of summer cooling was carried on at the Warm Air Heating Research Residence in Urbana, Ill. This bulletin presents a report of the results of this investigation.

During the first season a plant using ice as the cool-

ing medium was selected, because it was considered that the cooling load on the Residence could be most conveniently and accurately determined from the weight of ice melted. This cooling plant was located in the basement, the warm air drawn from the rooms of the Residence passing over a cooling coil and being returned to the rooms again by means of a fan through the regular distributing duct system. During the second season the principal objects of study were to find: (1) to what extent the circulation through the Residence of air taken from outdoors at night could be used to supplement or to replace artificial cooling during the day; and (2) the relative merits of natural ventilation, of a fan in the forced-air system, and of a fan in the attic as a means of circulating the air taken from outdoors at night. The investigation for the summer of 1934 was undertaken with the object of determining to what extent a 2½-ton mechanical refrigerating unit could be used to produce satisfactory cooling in the Residence, both when supplemented by the circulation of outdoor air through the house at night with the second-story windows open, and when not so supplemented.

[*"Investigation of Summer Cooling in the Warm-Air Heating Research Residence," by A. P. Kratz, M. K. Fahnestock, and S. Konzo. Bulletin No. 290, published by the Engineering Experiment Station, University of Illinois, Urbana, Ill. Paper cover; 140 pages; 6 x 9 in.; copies available free until September 15, 1937, or until the supply is exhausted, after that the price will be $1.*]

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Heating Markets by Income Classes

Another volume of the series on "Consumer Use of Selected Goods and Services, by Income Classes" has been prepared by the Bureau of Foreign and Domestic Commerce. This volume covers the following nine cities: Portland, Oreg.; Casper, Wyo.; Oklahoma City, Okla.; Paducah, Ky.; Frederick, Md.; Des Moines, Iowa; Lansing, Mich.; Erie, Pa.; Burlington, Vt.

This book, like its predecessors, is based on the Real Property Inventory of 64 cities made in 1934. The present volume covers about 12% of the entire family population of the nine cities. The book is primarily statistical with the tables arranged according to nine income classifications and show what proportion of the number of families in each classification have houses of a particular type made of a given material and with a certain type of heating apparatus burning a certain fuel. Less than one and one-half per cent of the reported families in these nine cities had incomes above $7000 and in every city at least 40% of the families had incomes less than $1000 for the year covered. The report shows that in these cities there are considerably more than three times as many families with incomes between $1000 and $2000 as families with incomes from $2000 to $3000. Except in Casper, Wyo., where practically no oil is reported for house-heating purposes, over 15% of the users of fuel oil are among the families reporting incomes of $3000 or more.

Fifteen tables are included for each city and each table is broken down into 12 divisions, two of which relate to heating. The data are extremely valuable for manufacturers, advertisers, market research specialists, and others.

[*"Consumer Use of Selected Goods and Services, by Income Classes," Market Research Series No. 5-10, by Ada Lillian Bush. Published by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington. Size 8 x 10½; 155 pages; price, 25c.*]

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BRIEF REVIEWS

GAS HEATING. Includes reports on the relative value of gas designed and conversion burner equipment; the value of atmospheric conversion burners and power conversion burners; the value of selling insulation; the prevalence of chimney trouble and means of eliminating it; the value of various gas heating controls; and recommended research to be undertaken by manufacturers. [*"Gas Equipment and Home Insulation Factors in House Heating." Interim Bulletin No. 33, published by the Commercial Section of the American Gas Association, New York. Paper cover 3¾ x 8½ in., 32 pages.*]

ACTIVATED ALUMINA. Presents the properties and applications of activated alumina which is a solid adsorbent which may be employed for the dehydration of gases, vapors, and liquids. It is used as a dehydrating medium in air conditioning equipment. Presents data on the physical characteristics, the adsorptive efficiency and application to air conditioning. Two psychrometric charts are included. [*"Activated Alumina, Its Properties and Uses," published by the Aluminum Company of America, Pittsburgh, Pa. Spiral binding; 5¼ x 8¼ in.; 42 pages.*]

SHEET METAL WORKERS GUIDE. Presents sales material and tables, as well as fabricating hints on various United States Steel sheet products, including black, galvanized, terne, tin plates and stainless steel sheets. Tables include data on weights and properties of galvanized sheets, galvanized sheet gages, carrying capacities of sheet metal pipes, and weight per lineal foot for galvanized rectangular ducts. [*"A Guide for Sheet Metal Workers," published by the United States Steel Corporation Subsidiaries. Heavy paper cover; 5 1/5 x 8¼ in.; 64 pages; copies obtainable from sheet metal suppliers.*]

CALCIUM CHLORIDE. A bulletin to furnish information on the properties, use, and control of straight calcium chloride as the brine medium in refrigeration and ice manufacturing systems. Booklet is divided into four sections: (1) calcium chloride refrigerating brine; (2) calcium chloride brine in practical use; (3) refrigeration in general; and (4) miscellaneous data. This latter section includes information on the toxicities of common gases and vapors; heat conductivity; piping for cold storage; and storage properties of foods. [*"Calcium Chloride in Refrigeration," published by The Solvay Process Co., 40 Rector St., New York. Bulletin No. 4. Heavy paper cover; 6 x 9 in.; 40 pages; available on request.*]

NEWS OF THE MONTH

Ray Goddard Re-Elected by Stoker Manufacturers

WHITE SULPHUR SPRINGS—The most successful annual meeting ever held by the Stoker Manufacturers' Association took place here June 3-4. The Association's program in research, engineering, advertising, trade practices and legislation were discussed at length by executives of member companies attending the two-day conference, with the first day's meeting being devoted to executive consideration of these and other industry problems.

The sessions on the second day were in the nature of open meetings at which time representatives of railroads, coal operators, trade associations, heating engineers and the press were present. Short addresses on subjects of mutual interest to the stoker and allied industries were made by the following: J. D. Battle, executive secretary, National Coal Association; J. E. Tobey, manager, fuel engineering department, Appalachian Coals, Inc.; W. B. Hughes, manager, automatic coal burning division, American Radiator Co.; Ralph A. Sherman, fuel engineer, Battelle Memorial Institute; Allen J. Johnson, director, Anthracite Industries Laboratory; A. F. H. Scott, assistant to president, Anthracite Industries; E. K. Scoggin, Minneapolis-Honeywell Regulator Co.; and Malcolm E. Henning, vice-president, Penn Electric Switch Co.

Ray C. Goddard, vice-president, Combustioneer Division, Steel Products Engineering Co., was re-elected president of the Association; E. C. Sammons, vice-president, Iron Fireman Manufacturing Co., was elected vice-president; and G. Walter Ostrand, plant manager, Link-Belt Co., was chosen treasurer. Marc G. Bluth, Chicago, was reappointed as secretary.

The president announced the appointments of the various standing committee chairmen for 1937-1938:

Advertising and Public Relations: J. M. McClintock, manager, stoker division, Illinois Iron & Bolt Co., Chicago.

Commercial: B. O. Fink, President, Auburn Foundry, Inc., Auburn, Ind.

Engineering: B. M. Guthrie, chief engineer, stoker division, Fairbanks, Morse & Co., Chicago.

Membership: J. E. Martin, Link-Belt Co., Chicago.

Research: J. R. Whitehead, manager, stoker division, Fairbanks, Morse & Co., Chicago.

President Goddard is chairman of the executive committee with the following members: E. C. Sammons, G. Walter Ostrand, B. O. Fink, and J. R. Whitehead.

The Association voted to continue its financial support to Bituminous Coal Research, Inc., and to the activities of the Committee of Ten, Coal & Heating Industries. It was also decided to hold meetings of the Association's executive representatives three times a year in addition to the annual meeting. Chicago was designated as the meeting place.

Three new active members were admitted into the Association: stoker division of the Morse Chain Co., Detroit; the Winkler Manufacturing Co., Lebanon, Ind., and the stoker division, Anchor Stove & Range Co., New Albany, Ind. Two associate memberships were accepted: the Automatic Coal Burning Division of American Radiator Co., and the Detroit Lubricator Co.

Wants Catalogs

READING, PA.—Reese and Company, with headquarters at 940 Spruce St. here, has been organized to furnish engineering service to clients and to act as wholesalers for the distribution of heating, ventilating, air conditioning, and other supplies. The firm desires to receive catalogs, data, prices on materials and equipment from interested manufacturers.

Water Supply Subject of Chicago Meeting

CHICAGO—D. S. Boyden, national president of the ASHVE, spoke at the May 10 meeting of the Illinois Chapter held at the Hotel Sherman, and which was attended by 114 members and guests.

The report of the special committee appointed to study the water problem in connection with air conditioning in Chicago's central business district was read by O. W. Armspach, chairman. This report pointed out that, at the present cost of water and equipment in Chicago, use of city water for condensing purposes will result in the lowest cost of operating air conditioning systems. However, an increase in cost of water, or a reduction in cost of water saving devices can change this economic relation to favor water conserving equipment. The inadequacy of the sewer system promises eventually to rule out the use of city water for condensing purposes.

The recommendations of the committee were: (1) Where conditions at the building permit, the equipment should be designed for heat dissipation to the atmosphere in lieu of the sewer; (2) where equipment is connected to the city water and sewer systems, automatic devices should be provided to regulate the quantity of water used. The excess use of water, particularly under less than maximum load conditions, should be discouraged: (3) air conditioning equipment for all buildings falling within the so-called loop area which are connected to the city water or sewer systems should be designed to use the minimum quantity of water consistent with good engineering practice.

The report followed with a discussion of cooling towers and evaporative condensers. It presented a table of comparative first costs, operating costs, floor space required and weight of city water, natural draft towers, forced draft towers and evaporative condensers. It also warned against corrosion of air conditioning equipment from the sulphur dioxide present in the loop atmosphere.

This report was accepted and filed and, upon motion of John Aeberly, a copy sent to Chicago's city engineer.

The following officers were elected for the 1937-1938 season: L. S. Ries, president; S. I. Rottmayer, vice-president; C. E. Price, secretary; J. R. Vernon, treasurer; M. W. Bishop, Tom Brown, E. M. Mittendorff, board of governors.

Investigates Electric Heating

SEATTLE—Prof. Carl E. Magnusson, University of Washington, has outlined the possibilities of electric heating in the homes in the Pacific Northwest. In a report prepared at the request of the Washington State Planning Council, Professor Magnusson described the future heating of homes by electricity as a factor of great import to electric utilities in this section. However, the power rate, already low in the Puget Sound region, must be lowered further to make electric house-heating popular. According to Professor Magnusson a 3½ mill rate per kilowatt-hour will be necessary. This compares with the ¾ cent rate now in use for consumption in excess of 240 kilowatt-hours.

Refrigerated Planes to Fly

NEW YORK—The first refrigerated airplanes in the world will be put into service during July by Northwest Airlines, which operates between Chicago and Seattle. The planes will be equipped with refrigerated freight compartments to carry such perishables as oysters, cut flowers, and other items.

Test Building for World's Fair Materials

NEW YORK—Mystery of the unique "test building" on the grounds of the New York World's Fair was dispelled recently when Grover Whalen, president of the Fair, revealed the function of the structure. The activities having to do with both the inside and the outside of the building, he said, are evidence of the extent to which the Fair Corporation will institute its own laboratories in providing safe, attractive structures for the 1939 exposition.

The test building, it develops, is versatile. It can be made to twist, heave, buckle, or sag at the will of the Fair's engineers. It is typical of nothing other than itself, a set of walls, of exhibition building height, upon which to try out the merits of various types of wall coating and different stucco treatments.

Ground consolidation, wind pressure, fire resistance, stucco layering, weather tightness, stud spacing, paint acceptance, insulation against change in temperature, light refraction, illumination possibilities, ceiling heights, flexibility of material, facade contours, and economies consistent with temporary building are a few of the factors governing research as carried on within and without the test building.

Within the building, a box-like structure, 60 x 40 ft. on the ground, with a sawed-off tower and a doorway involving columns at one end, lighting engineers have set up a typical exhibit hall for the purpose of studying and perfecting new lighting devices. Certain sections of the exterior walls serve as projection screens for testing illumination equipment. Other wall surfaces have been studded with crushed uranium glass, mica particles or other reflectors of light, to enable the engineers to work out effects of radiant or glowing exterior wall coatings.

The building code of the Fair Corporation is, in part, responsible for institution of the test building, since it provides that all walls in all exposition buildings must have at least ½-hr. fire resistance. The test building is not a rigid frame. Its flexibility is in part controlled by a latticework of adjustable steel rods. It is provided, too, with pillar foundations so constructed that the engineers can produce at will an artificial ground settlement as they study the adaptability of different materials in different combinations.

Stucco on steel studding and on wood studding; stucco in different layerings on paper-backed metal lathe and on thermax, a combination of wood, excelsior and magnesite binding; concrete stucco high in lime content; water-proofed gypsum plaster; and cast cinder block lumber are among the array of materials being tried on exterior walls of the test building. Trials for interior walls are being accorded such materials as ½-in. gypsum wallboard, thin asbestos cement boards, and sectional sheet steel wallboard.

The roof of the test building is covered in sections, employing slag as well as smooth-surfaced materials. It is considered likely that all roofs of Fair buildings will be coated with aluminum paint, which repels a high percentage of the sun's rays.

Unit Heater Standardization

DETROIT—The Industrial Unit Heater Association will hold its third regular meeting at the Hotel Cleveland, Cleveland, July 15, when consideration will be given to the report of the engineering committee covering the standardization of unit heaters, a subject which has been under consideration for the past year. It is hoped that with the adoption of a program of simplified practices benefits will be obtained both by the buying public and the manufacturer.

Proposes Pure Air Departments

CLEVELAND—Pure air departments to supplement present pure water departments were proposed for American municipalities at the Building Officials' Conference of America by T. A. Marsh, central division engineer of Iron Fireman Manufacturing Co.

"Public health authorities long ago recognized the danger of water-borne diseases, and pure water departments to guard against contaminated water supplies are considered necessary in every hamlet," he pointed out. "Health authorities have also recognized that pulmonary ailments are caused and aggravated by smoke-polluted air, but abatement of the smoke nuisance through city regulation has lagged far behind elimination of water pollution.

"The cases of water and air are analogous with relation to public health. They are the most vitally necessary elements of human survival, and each constitutes a perfect medium for the introduction of disease into the human system, as it is impossible for any individual to escape their use."

Phila. Burner Group Meets

PHILADELPHIA—A luncheon meeting of oil burner and fuel oil representatives, distributors and dealers was held under the auspices of the Oil Burner Division of the Electrical Association of Philadelphia, May 26. G. Harvey Porter, managing director of Oil Burner Institute, as guest speaker, outlined the purposes of OBI's regional program for the improvement of key market conditions and practices on a cooperative basis.

Mr. Porter related the accomplishments of similar goups in Boston and Washington, remarking that open discussions permitted members of the industries concerned to know each other better, and to realize that the welfare of each factor in a market depends upon the majority establishing and living up to high standards of sound business practices. At the conclusion of his remarks Mr. Porter suggested an open discussion of local problems and practices.

He stated that certain problems could be assigned to the equipment manufacturers and fuel oil companies for action while the local group would have to assume the responsibility of solving other problems of a distinctly local nature. As a result of Mr. Porter's invitation, F. C. Haab, chairman of the Philadelphia oil burner group, suggested that another meeting be called to catalog conditions and to make specific assignments to each of the three major factors concerned.

Forty representatives of oil burner, fuel oil, and accessory companies were present.

Dust Control Standards Under Way

CLEVELAND—Standards of dust control practice are rapidly nearing completion by the engineering committee of the Dust Control Equipment Association, according to announcement by Arthur J. Tuscany, executive secretary of the Association.

The Association has arranged for representation of its engineering committee on the American Foundrymen's Association safety and hygiene committee and the Air Hygiene Foundation, and request has been made for representation on the ASA committee Z-9. which is giving attention to the development of fundamentals relating to the design of exhaust systems.

Mr. Tuscany directs attention to the fact that neither the Dust Control Equipment Association nor its engineering committee propose to prepare codes, but it is further pointed out that the services, advice, or assistance of the committee is available to any group which is interested in going into the dust control question.

Woods Addresses California ASHVE and ASRE

LOS ANGELES—Two hundred eleven members and guests attended the May 11 meeting of the ASHVE Southern California Chapter with the ASRE local chapter. Among the guests were about 40 students who had been especially invited to hear Dean Woods of the University of California talk on air conditioning.

Doctor Woods spoke on "The Progress in Air Conditioning Studies" in which he told of the research being done at the University of California. He pointed out four fields for further research in air conditioning as follows: (1) Dust in the air; (2) automatic regulation; (3) cooling tower performance; and (4) heat pumps. Doctor Woods also spoke about comfort conditions and the effect of radiation on the feeling of comfort.

O. W. Ott, reporting for the research committee, said that the cooling tower and surface cooling research project at the University of California was about ready to proceed. Mr. Ott also told the members that a new chapter of the ASHVE had been recognized in San Francisco. Doctor Woods will be the first president of the new chapter.

The following ASHVE officers were elected for the coming year: E. H. Kendall, president; H. M. Hendrickson, vice-president; J. F. Park, secretary; A. W. Cooper, treasurer; O. W. Ott, P. C. Scofield, W. D. Fabling, and Leo Hungerford, board of governors.

Fifth Exposition Plans Progressing

NEW YORK—Perfect weather indoors the year 'round will be a theme of the Fifth International Heating and Ventilating Exposition to be held at Grand Central Palace here January 24 to 28, 1938. The Fifth Exposition is the latest in a series, under the same management, presented at two-year intervals in leading cities. The first was held in Philadelphia in 1930, the second in Cleveland, the third in New York. The Fourth Exposition, in 1936, was held at the International Amphitheatre in Chicago. The 1938 Exposition will feature the engineering response of the industry to the increased building activity which is in progress in practically every section of the United States.

Ice Company Reports 16 A.C. Jobs

NEW YORK—Theaters, night clubs, and even hospitals, are rapidly turning to dependable ice-cooled air conditioning equipment, according to C. F. Holske, manager of the American Ice Company's air conditioning department. Since January 1, that company has secured one new ice-using installation in Washington, four in Philadelphia and 11 through its subsidiary, the Knickerbocker Ice Company, in New York.

Two of the new theater installations in New York, namely, the Barrymore and the Biltmore, took advantage of the unusually warm Decoration Day week-end to dedicate their new ice-cooled equipment and reported satisfactory results.

British Gas Firm Enters A.C. Field

LONDON—The gradual awakening of the United Kingdom to the virtues of air conditioning is steadily bringing more concerns into the manufacturing field. The latest development is the decision of the Imperial Continental Gas Association, an important enterprise controlling gas supply undertakings in Britain and Continental Europe, to take a substantial financial interest in Abair Engineering, Ltd. The latter concern, formed with a nominal capital, has as its primary object the development of a business in air conditioning and similar activities in Britain and the Continent. A number of successful installations have been completed.

Buy A.C. Now, Urges Henderson

WASHINGTON—The man who beats the rising trend of prices for materials and labor by building a home this year, instead of waiting until 1938 or later, can get his full air conditioning installation "free" through the economies he thus effects, William B. Henderson, executive vice-president of the Air Conditioning Manufacturers' Association, declares.

"Re-figuring of contractors' prices on a house built in a large Great Lakes city in May, 1936, at a cost of $19,175.13, shows it would require $22,519.12 to duplicate it today," he said. "Contractors in a middle west city report that labor costs and materials price advances there are practically identical. The situation extends through all price classes of residential construction and the rises will continue. Costs cannot stand still. Materials prices are fairly stable but it is agreed they by no means are at their peak. There will be no reduction in labor costs. It is certain there will be some advances.

"In the light of the general increases of the past twelve months, and the anticipated continuance of advances through the next year and longer, it is apparent that the differential between present and future costs in the case of all but the cheapest types of construction, assures anyone who builds this year a saving sufficient to finance the installation of full year-round air conditioning."

Delavan Forms Company

DES MOINES—Nelson B. Delavan has resigned as vice-president and director of sales of Penn Electric Switch Co. and has announced plans to form a new company with headquarters in this city. The move was brought about by Penn's change of headquarters from Des Moines to Goshen, Ind.

N. B. Delavan

The new company which Mr. Delavan is forming will be called the Delavan Engineering Co. and will act as factory engineering sales representative for a few companies in seven midwestern states. Associated with Mr. Delavan will be R. D. Marshall and R. A. Smith, both formerly with the Penn.

Winkler Stoker Company Formed

LEBANON, IND.—Winkler Manufacturing Corp. of this city has purchased the plant and equipment of Indestructible Wheel Co., and has started regular production on its line of Winkler stokers. Eight models are planned with sizes from a domestic unit up to one burning 750 lb. of coal per hr.

The company plans to have its own distributing organization to handle the marketing of its products.

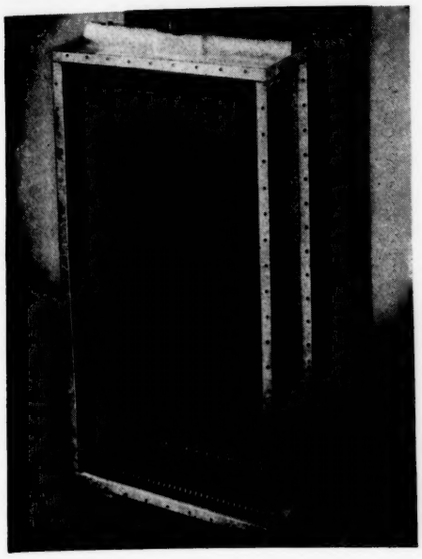
Carl J. Winkler is president and treasurer of the company; Herman E. Winkler is vice-president in charge of engineering and sales and Garth Scott is secretary.

A.C. Sales Break Records

WASHINGTON—Installed cost of equipment sold by the members of the Air Conditioning Manufacturers' Association broke all records in the first four months of 1937, aggregating $41,311,301, an increase of 180% over the sales of $14,756,992 in the same months a year ago, and a total not reached in 1936 until October, according to announcement here today by William B. Henderson, executive vice-president.

April sales were second highest of any month in history, being $9,663,009, an increase of 156.8% over the April, 1936, total, which was $3,751,015.

NEW EQUIPMENT



Modine Blast Heater

NAME—Modine blast heater.

PURPOSE—For heating, ventilating, air conditioning and process application.

FEATURES—An expansion bend allows each tube to expand and contract as its temperature requires without affecting the tube adjacent to it. The heaters and tubes are cylindrical and seamless for structural strength. Tubes and heaters are brazed into a single unit. All steam-carrying passages of the condensers are of copper or copper alloy. The fins are metallically bonded to the tubes to make a permanent junction. The orificing of tubes is said to have been eliminated by a special steam distributing plate which is designed to ration the steam evenly to all tubes the full width of the condenser.

SIZES AND CAPACITIES—Available in 252 sizes and capacities.

LITERATURE AVAILABLE — Catalog No. 337.

MADE BY—*Modine Manufacturing Co., Racine, Wis.*

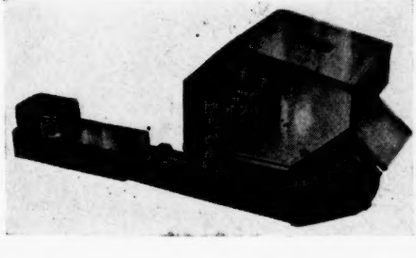
Free-Man Domestic Stoker

NAME AND MODEL NUMBER—Domestic stoker, model H-2.

PURPOSE—For automatic coal burning.

FEATURES — Stoker has the regular Free-Man rectangular retort with sectional tuyeres, cast iron feed pipe, continuous feed transmission and a large capacity steel hopper with a cast iron hopper base. Comes complete with automatic controls including automatic control damper which regulates fire during idling periods. Unit is low priced.

MADE BY—*Free-Man Stoker Div., Illinois Iron and Bolt Co., Carpentersville, Ill.*



Young Streamaire Convectors

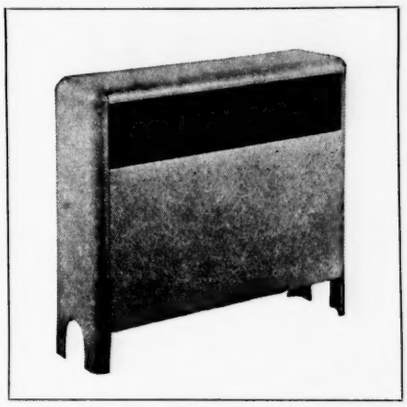
NAME—Young Streamaire convectors.

PURPOSE — Copper convectors for use with either steam or hot water heating systems.

FEATURES—Large elliptical copper tubes are used in the heating elements of these convectors. The manufacturer states that this shape of tube results in a large area of the tube surface being in contact with the direct air and also makes it possible for the convectors to be used with one-pipe steam systems as the condensate can flow along the bottom of the tube leaving most of the tube surface exposed to the steam. The extended surfaces on the tubes are stamped from pure copper and are vertically crimped for strength and metallically bonded to the elliptical tubes. The tubes are brazed by a patented process to one-piece malleable iron end tanks which are designed to give even distribution of steam or water to the tubes. Heavy gage steel side plates protect the edges of the fins. The heating element is said to be capable of withstanding an operating pressure of 50 lb. per sq. in. saturated steam, or 100 lb. per sq. in. hydrostatic. A complete line of cabinets for convectors for these heating units is available and include the following: free standing convector cabinets, wall-hung convector cabinets, partially recessed convectors, fully recessed convectors, and plastered-in concealed convectors.

LITERATURE AVAILABLE — Catalog No. 4037.

MADE BY—*Young Radiator Co., Racine, Wis.*



Foster Wheeler Expansion Joint

NAME AND MODEL NUMBER—Stainless steel bellows expansion joint, type S.

PURPOSE—For providing for expansion in pipe lines.

FEATURES—Steel is used exclusively in this expansion joint. Each joint consists of four essential parts: (1) two forged steel flanges; (2) stainless steel bellows; (3) internal sleeve and limit stops and (4) external sleeve. The bellows assembly consists of thin stainless steel discs welded together, alternately close to the external and internal edges. Each end of the bellows assembly is welded and sealed to the adjacent flange by means of a heavy reinforcing ring. The internal sleeve is a free sliding fit within the flanges and acts as a guide for their movement. A limit stop ring is welded to each end of the internal sleeve and the flanges are counterbored to provide shoulders to engage the limit stops when the joint is fully extended. This prevents over-extension of the bellows and damage to the joint. The external sleeve provides a support for the insulation and prevents foreign material from falling in between the plates of the bellows. Among the characteristics claimed by the manufacturer for this joint are: ample strength to carry high pressures; greater movements afforded due to the flexibility of special stainless steel bellows; no servicing or attention; minimum pressure drop.

TYPES AVAILABLE—For small movements (a maximum of 3/8 in.)—an axial traverse compact expansion joint in sizes from 1 1/2 to 24 in. For large movements up to 8 in.—double movement joints are available. Joints for universal movement are made specially to order to fit specific operating conditions.

LITERATURE AVAILABLE—Bulletin X-37-4.

MADE BY — *Foster Wheeler Corp., 165 Broadway, New York.*

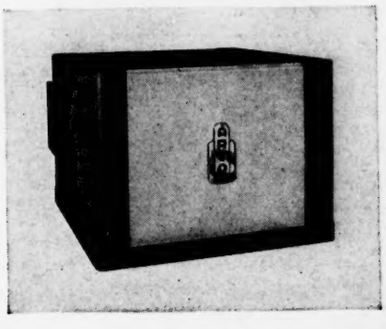
Arco Cooling Equipment

NAME — Cooling attachment for Arco air conditioners models 101-B and 201-B.

PURPOSE—An auxiliary device designed for installation on the discharge side of Arco air conditioners for use in connection with cold water cooling.

FEATURES—Tentative data indicate that it is possible to produce 1.6 to 2.1 tons of cooling with the first unit and 3.1 to 4 tons of cooling with the second when a cold water temperature of 50F is available. With the above performance the water rate on the smaller unit is from 3 to 6 g.p.m. and on the larger unit from 6 to 12 g.p.m. Performance data are based on the performance of 75% recirculated air at 80F dry bulb and 67F wet bulb and 25% outside air at 95F dry bulb and 75F wet bulb. The jacket of the new unit is finished in a green enamel with dark green ends to match the color of the Arco conditioner. The cooling coil can be used either with artesian well water or water artificially cooled.

MADE BY—*American Radiator Co., 40 W. 40th St., New York.*



Gorton Air Eliminator

NAME—Gorton high pressure air eliminator.

PURPOSE—For automatically venting steam coils, traps, and like equipment operating under pressures up to 150 lb.

FEATURES—The operating member is made of a special non-corrosive metal which is sensitive to heat changes. It is designed to close the valve at 212F and to keep it closed until the temperature drops below that point when it automatically opens the valve. The manufacturer states that the eliminator can be used on all pressure lines or equipment requiring automatic and quick air elimination under pressures up to 150 lb. The body of the device is made of bronze and is nickel plated.

SIZE—2½ in. diameter with ½ in. bottom pipe connection. Air outlet size, 3/16 in. diameter.

MADE BY—*Gorton Heating Corp., Cranford, N. J.*

Patterson Water Cooler

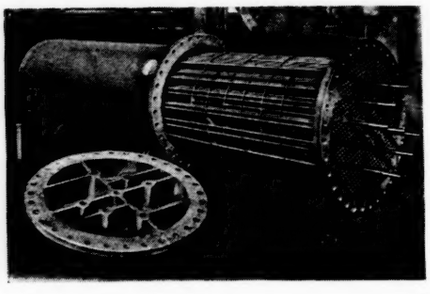
NAME—Patterson Freon water cooler.

PURPOSE—To cool water in closed or open circuits by the use of Freon or similar refrigerants.

FEATURES—Cooling is accomplished by expanding the refrigerant within the tubes and circulating water around them. Tubular cooling surface is in multi-pass arrangement, insuring a long travel of the refrigerant. Water is caused to flow back and forth across the tubes by means of a series of transverse baffles which is said to provide a turbulent flow throughout the entire travel. Coolers are built with welded steel shells, rolled steel tube sheets, semi-steel expansion chambers, and copper tubes and baffles. Tubes are U-shaped and expanded into the tube sheet. The entire tube bundle is said to be easily removable for inspection and cleaning.

SIZES AND CAPACITIES—Made in 17 sizes ranging from 5 to 100 tons of refrigeration.

MADE BY—*The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.*



Paragon Time Switches

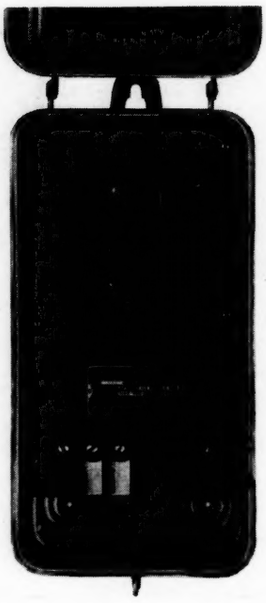
NAME—Paragon synchronous time switches.

PURPOSE—Time switches for either outdoor or indoor installation.

FEATURES—These new models of time switches have two improvements over the old models. The first improvement is a change in the case design. The new cases are drawn from 16 gage steel and are seamless. An interlocking joint between the shallow cover and the deeper base is made tight by a continuous cork gasket. The indoor models are finished in satin black lacquer with chromium hinge and hasp while the outdoor type is finished in weatherproof aluminum bronze and is fitted with a window to check operation without opening. The second improvement consists of a "clear-line" dial and trip assembly. There are two dial knobs, one frees or locks the dial to a frictionless arbor. When set at a fixed time there is no chance for slipping so that the instrument cannot build up a time-offage. The other dial knob frees or locks the adjustable switch trippers.

LITERATURE AVAILABLE—Bulletin 3743.

MADE BY—*Paragon Electric Co., 37 W. Van Buren St., Chicago.*



Goodrich Sheet Packing

NAME—Prenite 20M asbestos sheet packing.

PURPOSE—A sheet packing for use with equipment handling oil or refrigerants such as Freon, methyl chloride and sulphur dioxide.

FEATURES—The manufacturer states that this new packing offers increased resistance to oil and refrigerants. Absence of sulphur in its composition is said to make a packing that will not corrode metal parts.

SIZES—50 x 50 in. sheets in 1/32, 1/64, and 1/16 in. thicknesses.

MADE BY—*Mechanical Rubber Goods Div., The B. F. Goodrich Co., Akron, Ohio.*

Newark Low Water Cut-Off

NAME—Low water cut-off.

PURPOSE—A low water cut-off designed to eliminate vacuum difficulties and to shut off on low water up to 17 lb. pressure.

FEATURES—The new cut-off is compact, measuring only 8 x 4 x 3¼ in. It is said to have an unequalled accessibility, uses a new bellows type control and is made of steam bronze metal throughout.

MADE BY—*Newark Boiler Regulator Co., 15 Ward St., Bloomfield, N. J.*

Pier Arc Welder

NAME—Ace A. C. arc welders.

PURPOSE—For welding from 22 gage sheet metal up to heavy castings.

FEATURES—These welders incorporate a specially designed transformer with reactance and employ a circuit that provides a stable, non-blasting arc without a spatter loss. Through a special circuit and control, described as the Ace Synchro Control, the manufacturer states that both welding current and voltage are controlled in a manner comparable to that used on motor generator d.c. welders. Welders are designed and built in keeping with the standards prescribed by the American Welding Society and American Institute of Electrical Engineers.

SIZES AND CAPACITIES—Made in sizes from 15 to 250 amperes for use with from 1/16 to ¼ in. welding rod and voltages of 220 or 440 volts, 60 cycles.

MADE BY—*Pier Equipment Mfg. Co., Welding Equipment Div., 561 Cross St., Benton Harbor, Mich.*

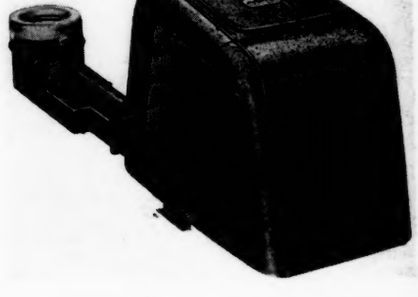
Butler Stokers

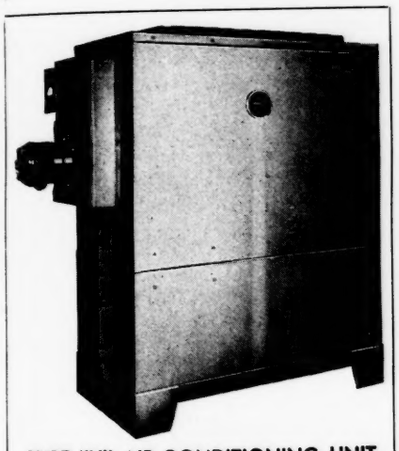
NAME—Butler standard and de luxe model domestic stokers.

PURPOSE—For automatically burning coal in domestic stoker boiler system.

FEATURES—These new stokers are much the same as the previous models manufactured by this company except that the hoppers are of a new design and are supplied in a hammerloid finish. This new finish gives the stokers a "hammered steel" effect and they now come in blue, white, green, bronze, red, and black. The de luxe model hopper, which is illustrated below, is trimmed with chromium.

MADE BY—*Butler Manufacturing Co., 13th and Eastern Ave., Kansas City, Mo.*





TYPE "X" AIR CONDITIONING UNIT

Herman Nelson A.C. Unit

NAME AND MODEL NUMBER—Air conditioning units, types X and Y.

PURPOSE—For both winter and summer air conditioning. Type X for commercial and large residential applications and type Y for domestic use.

FEATURES — These units are designed to provide both winter and summer air conditioning in combination or separately. They can be used with either steam or hot water. The standard type X model is designed for floor mounting but can be had for ceiling suspension as well. Both floor and ceiling models are made of two sections, one consisting of a dehumidifier and drain pan and the other of a heating coil and fan. Humidification is of the spray type. Unit is finished in a corrosion resistant gray baked enamel. Type Y is made in ceiling mounted type only. Spray type humidification is provided by Kant Klog spray heads. Cabinet is finished in opalescent brown baked enamel.

SIZES AND CAPACITIES—Type X made in three sizes with heating capacities ranging from 139,000 to 346,000 B.t.u. per hr. and cooling capacities from 4 to 15 tons with air circulation of 2000 to 5500 c.f.m. Type Y made in two sizes to provide from 65,500 to 147,750 B.t.u. per hr. heating and 2 and 3 ton cooling with 1100 to 1650 c.f.m.

MADE BY—*The Herman Nelson Corp., Moline, Ill.*

Portable Air Conditioner

NAME AND MODEL NUMBER—Portable air conditioner, BA-85.

PURPOSE—A portable air conditioning unit for cooling, dehumidifying, and filtering.

FEATURES—Unit needs only to be plugged into an electric circuit for operation. Operating mechanism, consisting of the compressor and motor, is cradled so that it floats in the chassis of the unit. Casing is finished with a crinkled lacquer surface said to have a texture that looks and feels like leather. The entire bottom rigidly supports the unit mechanically and acts as a deep pan to prevent oil or water from dripping on the floor. Compressor is of standard York construction, having exclusive features of Balanseal, Centriforce Oiler and Pressure Flex valves.

MADE BY—*York Ice Machinery Corp., York, Pa.*

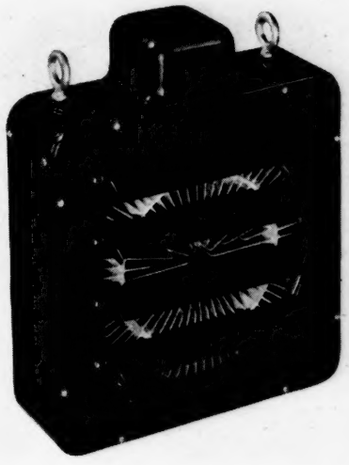
Electric Air Industrial Heater

NAME AND MODEL NUMBER — Electromode industrial heater, model IBN.

PURPOSE—For heating by electricity.

FEATURES — The heating source is a cast aluminum grid which has been poured around a calrod heating element. This grid construction is said to eliminate all hot wires and dead air spaces. A motor-driven, four-bladed aluminum fan, running on a graphite impregnated bronze bushing dissipates heat from the entire surface of the grid and circulates the warm air. It is said that heat can be directed wherever it is needed by moving a series of adjustable deflectors mounted on the front of the unit. Heater is equipped with an on and off switch and is provided with a thermal safety switch to prevent damage to the grid from overheating should the fan or air circulator stop. It is also obtainable with a thermostatic control. Heater may be suspended from the ceiling by means of eyebolts or fastened to the wall with angle braces.

MADE BY—*Electric Air Heater Co., Div. of The American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.*



Mercoid Warm Air Furnace Control

NAME—Combination fan and limit control.

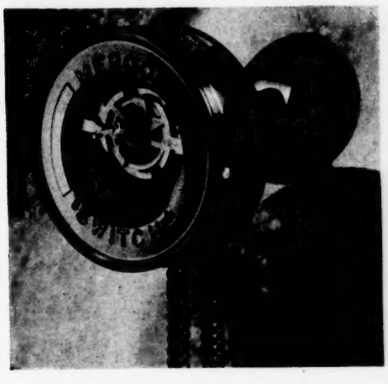
PURPOSE—A combination control for use in place of the usual limit switch in fan and blower control.

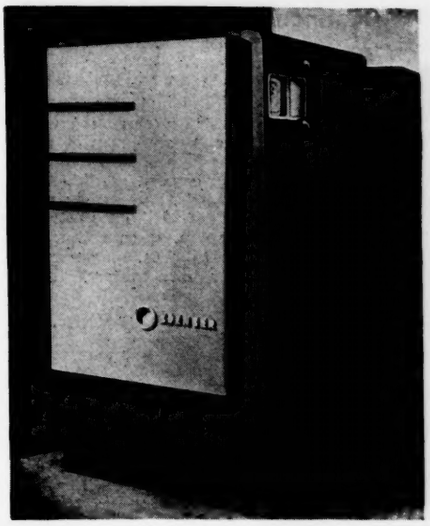
FEATURES — This control serves the same purpose as the type M-51 limit switch and the type M-53 fan and blower controls which have been used for many years. The new control contains all of the features of the two separate types, including ease of making adjustments, temperature indicating dial and sealed mercury contact switches.

RANGE AVAILABLE—The type M-80 range, 50 to 300F; type M-82 range, 50 to 200F.

LITERATURE AVAILABLE—Bulletin M-12.

MADE BY—*The Mercoid Corp., 4201 Belmont Ave., Chicago.*





Spencer Boiler Jacket

NAME—Spencer Heater new oil burning boiler jacket.

PURPOSE—A modernistic jacket for the Spencer line of oil burning boilers.

FEATURES—The jacket is produced in a metallic luster lacquer in two tones of silvery blue-gray. The color is said to be sufficiently neutral to blend with the oil burner or stoker equipment and with practically any color scheme that may be used in finishing the basement room in which it may be placed.

MADE BY—*Spencer Heater Co., Williamsport, Pa.*

Wagner Fan-Cooled Motor

NAME AND MODEL NUMBER—Totally-enclosed fan-cooled motors, type CP.

PURPOSE—For driving equipment which must be operated in atmospheres heavy laden with abrasive dusts, explosive dusts, corrosive gases, and extreme dampness.

FEATURES—This motor consists of a skeleton type stator, deeply grooved on the outside to increase radiation, which is provided with totally-enclosed ball bearing endplates with long machined fits to completely seal the working parts of the unit. An external blower mounted on the front end directs cooling air around the front endplate and over the corrugated surfaces and through a baffled back endplate down over the bearing. The movement of the air is directed over these surfaces by specially designed blower and frame shields.

MADE BY—*Wagner Electric Corp., St. Louis, Mo.*

American Radiator Pipe Hangers

NAME—American Radiator wrought copper pipe hangers.

PURPOSE—For supporting copper pipe.

FEATURES — Hangers are supplied with threaded and notched supporting rod which can be cut to allow different lengths for proper pitch. Two types of rings, split and solid, are used for the hangers and the supporting rod fits either type, permitting flexibility in assembly to the unit. The solid ring is made with adjusting screws to take up play and permit movement of pipe to allow for expansion and contraction and also to allow for adjustment for the acceptance of two sizes of pipe. Ceiling plates to support the hangers are provided in round and oblong shapes.

MADE BY—*American Radiator Co., 40 W. 40th St., New York.*

Continental Air Cleaning Unit

NAME—Clean Air.

PURPOSE—Low-priced portable electric air cleaner for use in homes and offices.

FEATURES—Apparatus draws room air through a fiber filter and two sprays of water at a rate of 60 c.f.m. Included with the unit is a 1000-watt heating element which can be switched on or off if desired to supply warm air sufficient to take the chill off the room. Unit is 13 in. high, 10 in. wide, and weighs 10 lb. Holds from 4 to 5 qt. of water and utilizes either a.c. or d.c. motors. Price, $18.95 f.o.b. Detroit.

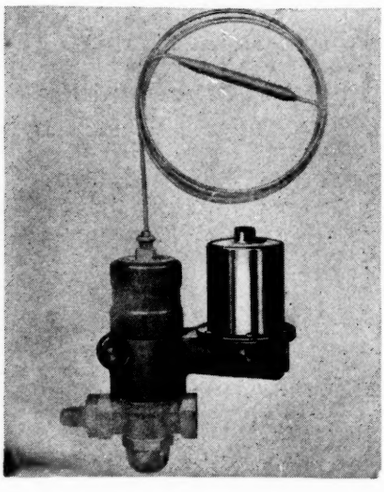
MADE BY—*Continental Motors Corp., Detroit, Mich.*

Johnson Modulating Attachment for Thermostatic Expansion Valves

NAME—Johnson modulating attachment for thermostatic expansion valves.

PURPOSE—Attachments to various standard makes of thermostatic expansion valves for making a complete unit which is controlled by a distant thermostat as well as the usual bulb on the outlet of the evaporator.

FEATURES—Valve is equipped with a Johnson compressed air motor to modulate the capacity of standard thermostatic expansion valves. The branch line of any standard Johnson instrument, such as a thermostat or a humidostat, is connected to the bellows which actuates the valve. The function of the attachment is to throttle the flow of refrigerant to the evaporator in response to the demand of the control instrument. When the control instrument calls for maximum capacity of the evaporator, the thermostatic member of the expansion valve operates in the conventional manner. The bulb of this member is fastened to the evaporator outlet and is adjusted to maintain the desired superheat. The pneumatic attachment for this device is said to actually meter the refrigerant to the coil according to the demand of the control instrument, giving true intermediate action.



TYPES AVAILABLE—Available with a number of standard makes of thermostatic expansion valves.

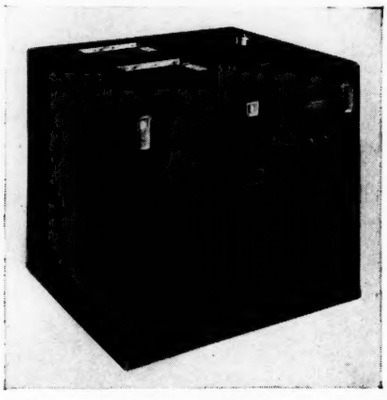
MADE BY—*Johnson Service Co., Milwaukee, Wis.*

American Radiator Large Home Air Conditioner

NAME AND MODEL NUMBER—American Radiator large home air conditioner, Nos. 301B and 1101B.

PURPOSE—Air conditioner of the upright type for large homes to operate with steam or hot water heating systems.

FEATURES—Unit is made in two models—the one 301B is self-contained in a chrome green jacket with a chromium trim and is built to stand on the floor beside a heating boiler, while the other, 1101B, is combined with the company's No. 11 oil boiler in a single jacket of plum color with copper trim. Units are designed with capacities up to 1850 c.f.m. and can be used for part air heating in the home. Air passage through the conditioner is U-shaped with a two-pass heating coil used across the unit for warming the air. Viscous type filters are used for air cleaning while humidity is supplied through a spray type humidifier operated against an adjustable target by a solenoid valve. A centrifugal blower is used to circulate the air. Warm water is used in the heating coil of the conditioner regardless if steam or warm water heating is used. In the case of the steam boiler the water is drawn out of the boiler to a pipe connected below the water line. A small pump is used to provide circulation of the water. One motor drives both fan and pump.



No. 1101B Model A. C.

CAPACITIES—Both units are capable of giving an equivalent of 500 sq. ft. of direct steam radiator surface.

MADE BY — *American Radiator Co., 40 W. 40th St., New York.*

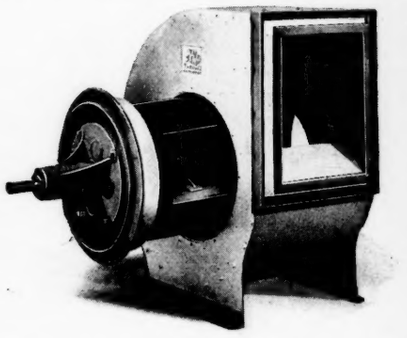
Industrial Gas Engineering Exhauster

NAME—High temperature exhausters.

PURPOSE—For exhausting high temperature gases.

FEATURES—All parts subjected to high temperatures are fabricated of various heat resisting alloys best suited to the operating temperatures. Double row self-aligning ball bearings are used. These are kept cool by an air cooling method which is said to prevent the transmission of heat to the shaft, to the bearings, keeping the shaft cool and rigid and eliminating water cooling. Access to the exhauster wheels is provided, the complete assembly wheel, shaft and bearings being readily removable by the removal of cap screws which fasten the assembly to the exhauster housing. Exhausters are available in double housing, insulated and air cooled construction, also single housing uninsulated construction.

TYPES AVAILABLE—Exhausters are made in three stock classes; class L for operating temperatures up to 800F; class M for operating temperatures up to 1000F; and class H for operating temperatures up to 1250F. Special units can be furnished with exhausters for temperatures up to 1800F.



MADE BY—*Industrial Gas Engineering Co., Inc., 201-203 E. Ohio St., Chicago.*

Climax Air Conditioners

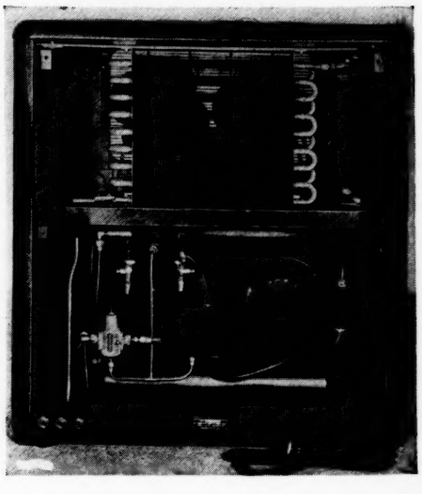
NAME AND MODEL NUMBER—Climax self-contained air conditioners, Nos. 20, 30, 40, and 50.

PURPOSE—For summer air conditioning.

FEATURES—Designed to cool, circulate, filter, dehumidify, and supply ozone. Equipped with a four-cylinder V-type compressor and an electric motor, both of which are water-cooled. Also cooled by water are a shell and finned type condenser and the compressor head. All models are housed in walnut cabinets which are insulated.

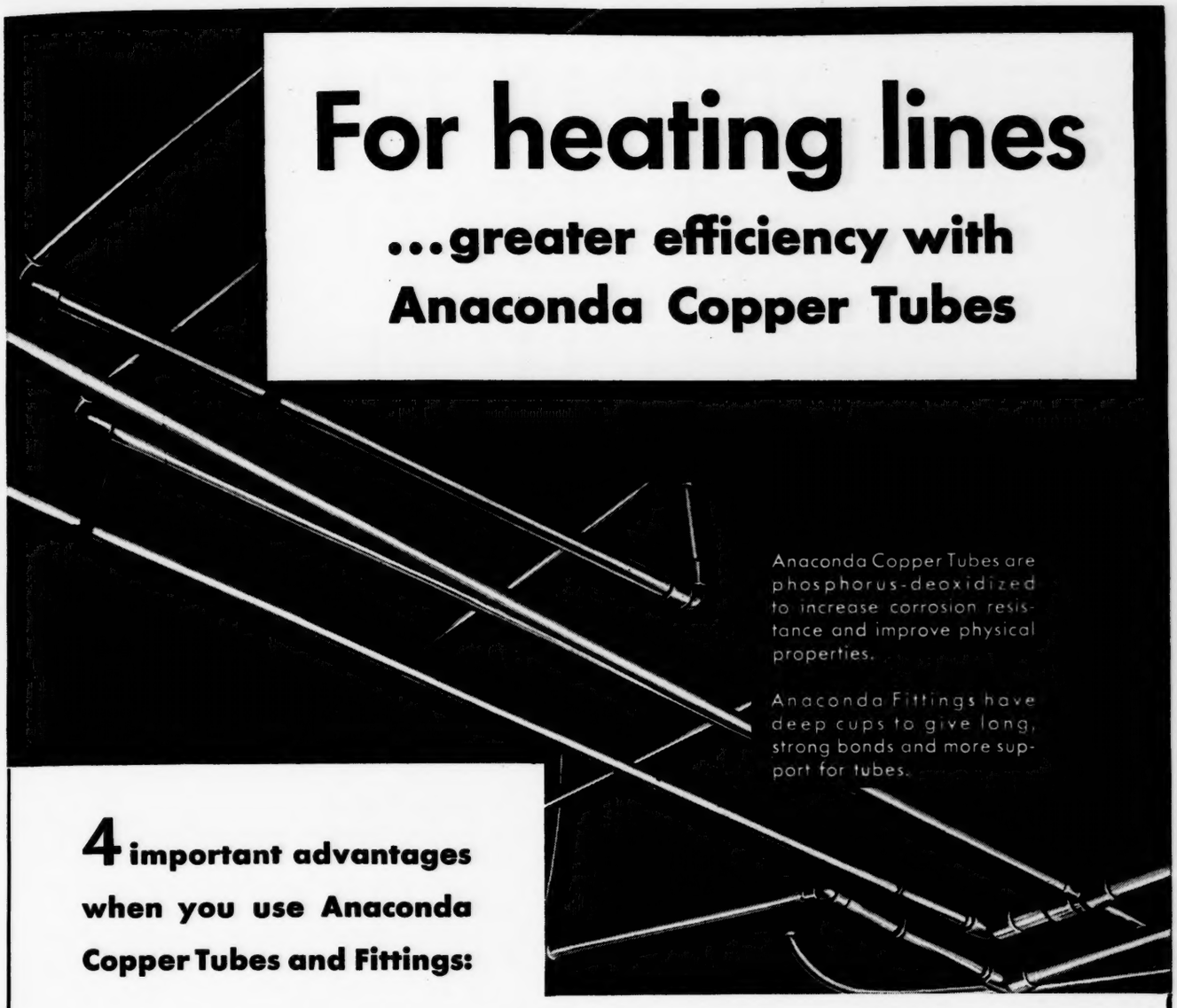
SIZES AVAILABLE—Four sizes with refrigerating capacities ranging from 3/10 to 1 1/10 ton and air circulation from 130 to 400 c.f.m.

MADE BY—*Climax Machinery Co., 121-153 E. Morris St., Indianapolis, Ind.*



For heating lines

...greater efficiency with Anaconda Copper Tubes



Anaconda Copper Tubes are phosphorus-deoxidized to increase corrosion resistance and improve physical properties.

Anaconda Fittings have deep cups to give long, strong bonds and more support for tubes.

4 important advantages when you use Anaconda Copper Tubes and Fittings:

1. They reduce resistance to flow. Smooth interior surfaces permit 10% to 15% greater velocity of circulation with the same head.

2. *Smaller size* tubes can be used than are required with rustable pipe.

3. They reduce heat losses materially. Lessen need of insulation.

4. *Cost is only a little more than rustable piping!* And Anaconda Copper Tubes and Fittings are *rust*-proof . . . a "lifetime" investment.

For low pressure heating lines, Anaconda Copper Tubes and Fittings offer important installation as well as service advantages. Slight inaccuracies encountered in running branch lines to radiators can be compensated for by bending the tubes, thus saving time and labor.

The complete Anaconda line of tubes and fittings in sizes from ⅛" to 8" is readily obtainable from supply houses. There is an Anaconda Solder Fitting for *every* heating requirement. 3741

ANACONDA

Anaconda DEOXIDIZED *Copper Tubes*

THE AMERICAN BRASS COMPANY · GENERAL OFFICES: WATERBURY, CONNECTICUT

Offices and Agencies in Principal Cities · In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

Degree-Day Figures for May, 1937

HEATING & VENTILATING continues its ninth year of publishing degree-day data for various large cities.

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for May, 1937	146	29	49	16	210	318	258
Degree-days, Sept. 1, 1936 to May 31, '37	5183	2727	4141	2367	5665	6571	7475
Degree-days, Sept. 1, 1935 to May 31, '36	6534	3279	4730	2926	6101	7288	7919
Degree-days, Sept. 1 to May 31, Normal	6889	2890	4533	2352	6045	6810	7620

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for May, 1937	375	263	142	208	148	199	111
Degree-days, Sept. 1, 1936 to May 31, '37	7666	6282	4968	5729	5279	6126	6712
Degree-days, Sept. 1, 1935 to May 31, '36	7379	6878	5599	6404	5984	5721	7270
Degree-days, Sept. 1 to May 31, Normal	7462	6290	4703	6155	5323	5874	6384

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for May, 1937	243	76	440	8	234	68	193
Degree-days, Sept. 1, 1936 to May 31, '37	6468	4158	9752	2755	5991	4380	6100
Degree-days, Sept. 1, 1935 to May 31, '36	7013	5268	10315	2338	6675	4940	6792
Degree-days, Sept. 1 to May 31, Normal	6490	5034	9245	2428	6266	4264	5934

	Grand Rapids, Mich.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Kansas City, Mo.	La Crosse, Wis.	Lincoln, Neb.
Degree-days for May, 1937	203	110	141	148	62	176	101
Degree-days, Sept. 1, 1936 to May 31, '37	6475	5176	5644	5437	5256	7714	6347
Degree-days, Sept. 1, 1935 to May 31, '36	7036	5652	6023	6106	5619	8148	6797
Degree-days, Sept. 1 to May 31, Normal	6535	5375	6036	5298	4852	7322	6059

	Little Rock, Ark.	Los Angeles, Calif.	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.
Degree-days for May, 1937	20	77	93	232	18	313	198
Degree-days, Sept. 1, 1936 to May 31, '37	3206	1467	4446	7551	3199	6972	8316
Degree-days, Sept. 1, 1935 to May 31, '36	3510	1140	4995	8012	3654	7499	8961
Degree-days, Sept. 1 to May 31, Normal	2811	1504	4180	7395	2950	7206	7850

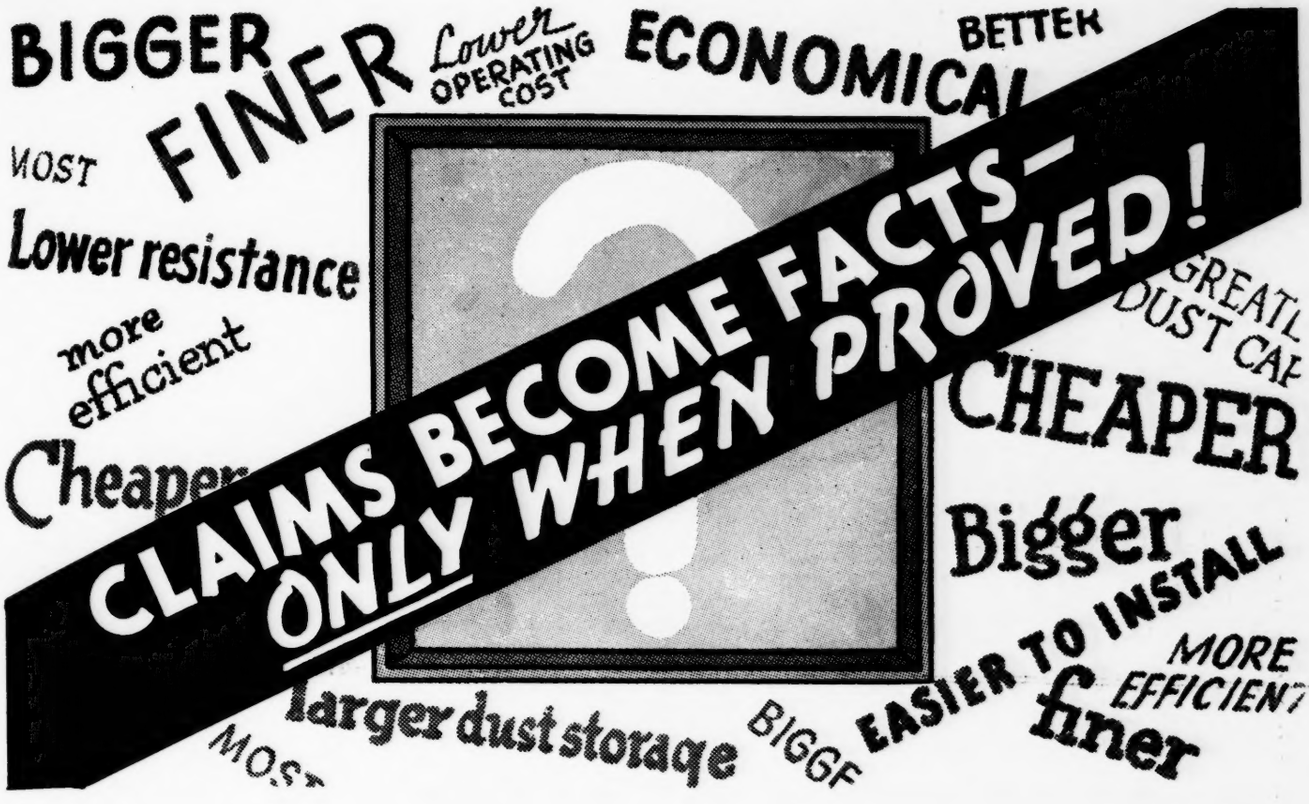
	Nashville, Tenn.	New Haven, Conn.	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma, City, Okla.	Omaha, Neb.
Degree-days for May, 1937	59	142	—	104	48	18	103
Degree-days, Sept. 1, 1936 to May 31, '37	3531	5397	1087	4852	3068	3990	6745
Degree-days, Sept. 1, 1935 to May 31, '36	4108	5863	1401	5363	3650	3931	7220
Degree-days, Sept. 1 to May 31, Normal	3578	5895	1024	5347	3349	3613	6131

	Peoria, Ill.	Philadelphia, Pa.	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.
Degree-days for May, 1937	137	73	131	292	208	176	99
Degree-days, Sept. 1, 1936 to May 31, '37	6002	4539	5018	6562	4416	5519	4948
Degree-days, Sept. 1, 1935 to May 31, '36	6640	4990	5721	6968	4384	5974	5491
Degree-days, Sept. 1 to May 31, Normal	6109	4855	5235	7012	4379	6014	5389

	Richmond, Va.	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.
Degree-days for May, 1937	49	228	64	106	244	170	253
Degree-days, Sept. 1, 1936 to May 31, '37	3678	6319	4768	5946	2802	5900	4583
Degree-days, Sept. 1, 1935 to May 31, '36	4238	6931	5336	5443	2214	6366	4435
Degree-days, Sept. 1 to May 31, Normal	3725	6732	4585	5555	2682	6129	4716

	Spokane, Wash.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for May, 1937	244	199	202	100	216	71	66
Degree-days, Sept. 1, 1936 to May 31, '37	6783	6225	6122	4959	3011	4207	4986
Degree-days, Sept. 1, 1935 to May 31, '36	6427	6851	6788	5492	7005	4740	5039
Degree-days, Sept. 1 to May 31, Normal	6274	6881	5893	4933	6796	4626	4673

To obtain unit fuel consumption figures for any city shown above, multiply the number of degree-days by the following factors: for coal, 0.008; for oil, 0.00069; for gas, 0.096. Figures obtained will show coal consumption in pounds per square foot of radiator surface; oil consumption in gallons per square foot; gas consumption in cubic feet per square foot—all for the period covered by the number of degree-days. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operation at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal; 140,000 B.t.u. per gal. for oil, and 1,000 B.t.u. per cu. ft. for gas. To correct for other heating values, efficiency and design conditions, follow the method explained in the "HEATING & VENTILATING Degree-day Handbook" or on H. & V.'s Reference Data Sheet Nos. 67 and 68. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.



IT'S easy to make claims—but claims don't become facts until they are **proved.**

The dust storms in the middle west offered an excellent opportunity for proving the claims that permanent washable filters were the most economical for air conditioning service.

Transcontinental trains caught in these storms when equipped with permanent washable filters of the American M/W type, arrived at their destination clean and comfortable despite the excess dust load imposed upon them. Cars in which replaceable types were used did not fare so well. These filters, because of their lower dust-holding capacity often became so clogged with dust before the trip was finished that they had to be removed to obtain any air at all in the car. This not only resulted in discomfort for the passengers but was expensive for the railroads, due to the extra cost of cleaning the cars as well as the frequent replacement of the filters.

This test so clearly demonstrated the superior performance and economical maintenance of permanent washable type filters that the American M/W filter has become standard equipment for railroad air conditioning. Following the first dust storm more than 1600 American M/W filters were ordered by transcontinental railroads to replace throwaway types in their air conditioned cars. Today more than 15,000 American M/W filters are serving over 7000 railroad cars in all parts of the country. Practically all of the new streamlined trains are equipped with M/W filters both for air conditioning and cleaning the intake air for the Diesel engines.

Manufacturers of industrial and domestic air conditioning equipment have taken a page from the experience of the railroads and are either offering permanent filters as standard equipment or are listing them as optional at small extra cost. Their own experience has further convinced them that it is false economy to impair the satisfactory performance of their air conditioning equipment with cheap renewable type filters that can only result in dissatisfaction because of frequent and expensive replacements.

Complete data on the larger dust-holding capacity, the higher efficiency and greater economy of permanent filters is available on request to manufacturers and dealers who wish to keep abreast of this latest trend in the air cleaning field.

AMERICAN AIR FILTER CO., Inc.

INCORPORATED

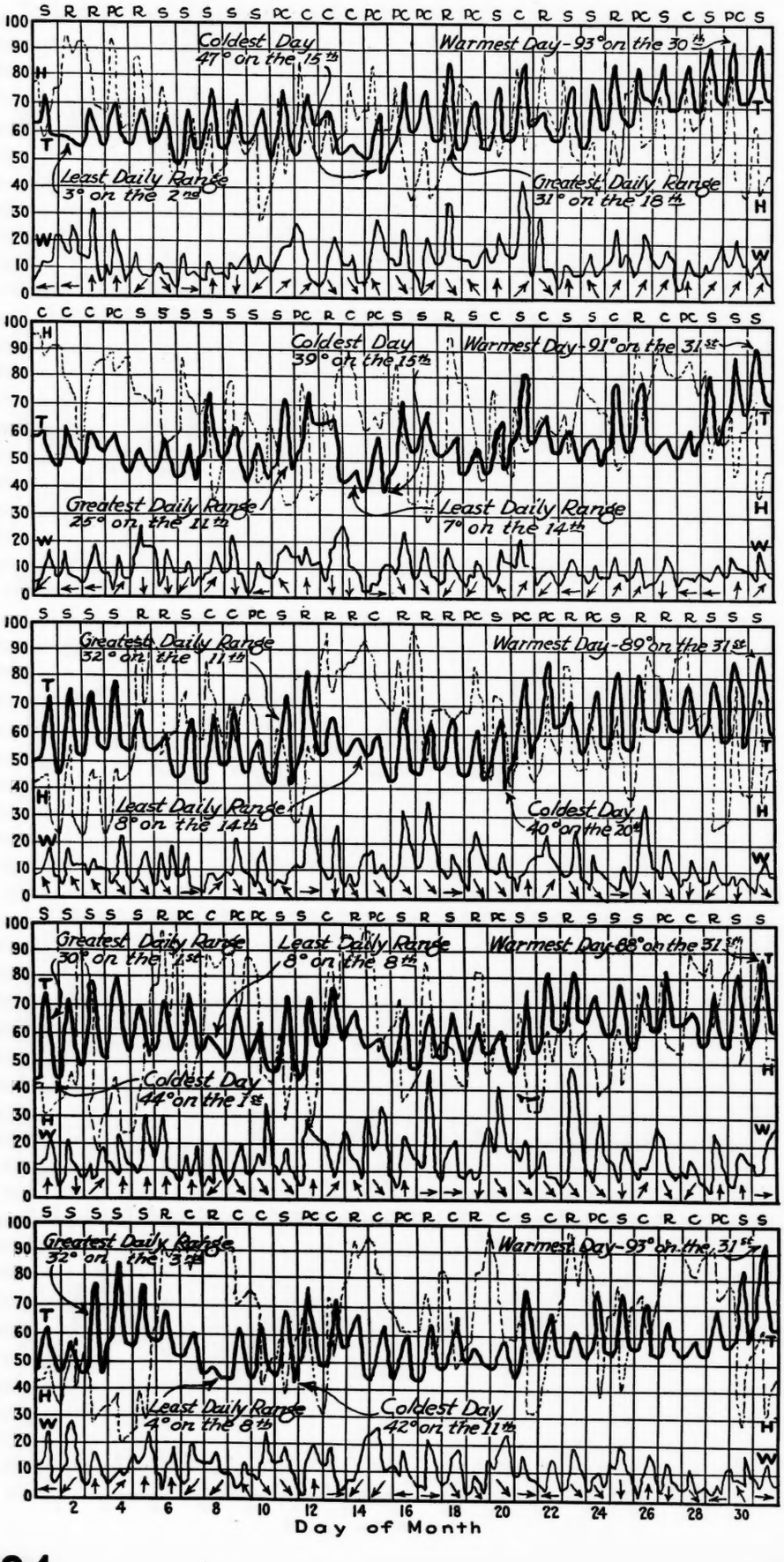
118 Central Avenue

LOUISVILLE - - - KENTUCKY

In Canada: Darling Bros., Ltd, Montreal P Q.

THE WEATHER FOR MAY, 1937

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.


Coldest Day 47° on the 15th
Warmest Day-93° on the 30th
Least Daily Range 3° on the 2nd
Greatest Daily Range 31° on the 18th
Coldest Day 39° on the 15th
Warmest Day-91° on the 31st
Greatest Daily Range 25° on the 11th
Least Daily Range 7° on the 14th
Greatest Daily Range 32° on the 11th
Warmest Day-89° on the 31st
Least Daily Range 8° on the 14th
Coldest Day 40° on the 20th
Greatest Daily Range 30° on the 1st
Least Daily Range 8° on the 8th
Warmest Day-88° on the 31st
Coldest Day 44° on the 1st
Greatest Daily Range 32° on the 3rd
Warmest Day-93° on the 31st
Least Daily Range 4° on the 8th
Coldest Day 42° on the 11th
Day of Month

St. Louis

Mean temp. for month, 67.2F; aver. wind velocity, 11.4 m.p.h.; prevailing direction of wind, S.

Chicago

Mean temp. for month, 57.9F; aver. wind velocity, 9.5 m.p.h.; prevailing direction of wind, NE.

Pittsburgh

Mean temp. for month, 61.4F; aver. wind velocity, 9.5 m.p.h.; prevailing direction of wind, NW.

New York

Mean temp. for month, 63.3F; aver. wind velocity, 13.0 m.p.h.; prevailing direction of wind, S.

Boston

Mean temp. for month, 59.1F; aver. wind velocity, 9.3 m.p.h.; prevailing direction of wind, W.

WITH THE MANUFACTURERS

The Brown Instrument Co., division of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has appointed *E. B. Evleth* vice-president and general manager, succeeding William J. Hajek who has taken a six months' leave of absence before resumption of active duties in an executive capacity with the Minneapolis office of Minneapolis-Honeywell. *Charles L. Saunders,* formerly Chicago regional sales manager, succeeds Mr. Evleth as resident vice-president in the western division. *Charles C. Cochran,* formerly of the Milwaukee office, has been transferred to Chicago to assist Mr. Saunders in all non-industrial sales activities throughout the midwest region of Minneapolis-Honeywell. *John B. Banks* has been named Milwaukee district branch manager, and *O. B. Wilson,* who has been manager of the industrial division at Chicago, will extend his activities over the middle west.

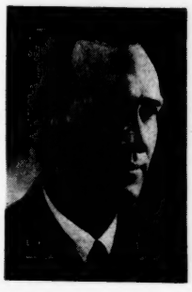
The Chicago office has taken over the entire 7th floor of the Furniture Exhibition Building at 433 E. Erie St. This change will allow Minneapolis-Honeywell 10,500 sq. ft. of office space for the Chicago area operation.

A prominent feature of the new office is a large display room in which controls and instruments are exhibited under actual operation.

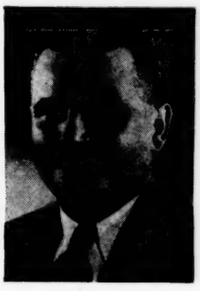
A. M. Byers Co., Pittsburgh, Pa., has appointed *Robert W. Law* division manager of its Boston office, at 518 Consolidated Building. Mr. Law has been connected with Byers since 1925 as sales representative in the New York division. He succeeds J. J. Riley.

The Central Foundry Co., New York, has moved its general offices and showrooms to *386 Fourth Ave.*, from 420 Lexington Ave.

Frigidaire Div., General Motors Corp., Dayton, has promoted *E. B. Newill,* chief engineer and director of research, to assistant general manager, and *S. M. Schweller,* assistant chief engineer, to chief engineer and director of research. Mr. Newill also becomes assistant general manager of the Frigidaire and Delco-Frigidaire Conditioning Divisions of General Motors Sales Corp., which market the refrigerating and air conditioning equipment manufactured by Frigidaire and Delco Appliance Divisions.



E. B. Newill



S. M. Schweller

After graduating from Georgia Tech in 1915, Mr. Newill entered the employ of Westinghouse. In 1929, he became associated with General Motors as vice-president in charge of engineering of General Motors Radio Corp., a position he held until June, 1930, when he was promoted to chief engineer of Frigidaire.

Mr. Schweller entered the service of the National

Thousands
OF SUCCESSFUL INSTALLATIONS . .

SUPPORT HEATING ENGINEERS' JUDGMENT IN SPECIFYING

Janitrol
GAS-FIRED
UNIT HEATERS

● Almost any heating problem you encounter is duplicated somewhere by a situation in which Janitrol Unit Heaters are giving highly satisfactory service. In plants, warehouses, offices . . . in shops, stores, restaurants . . . in theaters, night clubs, etc. . . Janitrol fully automatic gas-fired Unit Heaters are quietly and economically providing even, dependable heat where and when needed. Fourteen Janitrol models, with capacities ranging from 60,000 to 400,000 Btu per hour input assure availability of the correct fan speeds and temperature distribution. See Sweet's Catalog. Write us for interesting professional facts about these heaters and our cooperative engineering facilities.

Surface Combustion Corporation . . Toledo, O.

Janitrol
MADE BY
SURFACE COMBUSTION CORPORATION
. . . SPECIALIZING EXCLUSIVELY IN GAS HEATING EQUIPMENT . . . INCLUDING COLUMBUS AND HEATMASTER FURNACES

"MASTER"

He is a master workman, but to reach this position required years of training to achieve perfection in his work. Accuracy, reliability, precision must be a part of every job he does.

The Master line of controls is the result of years of engineering training, years of making instruments that have proven successful in actual operation. Accuracy, reliability and precision are built into every control that Master makes.

TYPE B-22

The ideal, low cost heat regulator for small homes. So staunchly is it made that it outlasts the heating plant. The Master is listed as standard by the Underwriters' Laboratories.

Made by the makers of the famous Type B-144, the original gradual control heat regulator.

WHITE MFG. CO.

2364 University Ave., St. Paul, Minn.

MASTER HEAT REGULATOR

Cash Register Co., in 1913. In 1916 he joined Delco as a draftsman, later becoming a designer. In 1921, he became a member of the designing staff of the Delco-Light Co., and in May, 1925, was made general foreman in charge of all Frigidaire assembly operations. This was followed in 1926 by promotion to assistant superintendent and in 1927 promotion to superintendent of the Taylor St. plant. In the fall of 1928, he was made assistant chief engineer in charge of product development. In 1934, he again became assistant chief engineer, the place he relinquishes to take over the top post in the division's engineering and research section.

The Mercoid Corp., Chicago, now has the following 35 distributors selling, servicing, and carrying in stock the company's complete line of automatic controls: Atlanta, Ga.: *Leo S. Bosarge*, 315 Spring St., NW.; Baltimore: *Parks & Hull Appliance Corp.*, 1035 Cathedral St.; Boston: *Melchior, Armstrong, Dessau Co.*, 614 Memorial Drive; Chicago: *Automatic Heat & Coal Supply Co.*, 647 W. Lake St.; *Robert Barclay, Inc.*, 122 N. Peoria St.; *Borg Warner Service Parts Co.*, 2100 Indiana Ave.; Dallas: *W. E. Lewis & Co.*, Construction Bldg.; Detroit: *R. L. Deppmann Co.*, 905 Holden Ave.; Hempstead, N. Y.: *Sid Harvey*, 234 Main St.; Kansas City, Mo.: *Forslund Pump & Machinery Co.*, 3033 Main St.; *U. S. Supply Co.*, 1315 W. 12th St.; Lincoln, Neb.: *Pioneer Electrical Co.;* Los Angeles: *Jensen Instrument Co.*, 624 E. 4th St.; Milwaukee: *Automatic Control Co.*, 2335 N. Teutonia Ave.; Mt. Vernon, N. Y.: *National Tank Co.*, 7-11 Beechwood Ave.; New York City: *Melchior, Armstrong, Dessau Co.*, 300 4th Ave.; *Preferred Utilities Mfg. Co.*, 33 W. 60th St.; Oklahoma City: *U. S. Supply Co.*, 706 W. Noble St.; Omaha: *U. S. Supply Co.*, 901 Farnam St.; Paterson, N. J.: *White & Shauger*, 435 Straight St.; Philadelphia: *Girard Plumbing & Supply Co.*, 710 W. Girard Ave.; *Pennsylvania Distributing Co.*, 2402 Market St.; Portland, Oreg.: *Refrigerating & Power Spec. Co.*, 1007 E. Burnside St.; Richmond, Va.: *Schultz & James, Inc.*, 7 N. 6th St.; St. Louis: *The Spangler Co., Inc.*, 3331 Market St.; Salt Lake City: *Stevens Sales Co.*, 32 S. West Temple St.; San Francisco: *Neil H. Peterson Co., Ltd.*, 1129 Folsom St.; Scranton: *Central Service & Supply Co.*, 209 Jefferson Ave.; Seattle: *Langdon-Faulkner Co., Inc.*, 302 Lloyd Bldg., Spokane, Wash.: *Heating Assurance, Inc.*, 121 N. Browne St.; Toledo: *Etna Electric Co.*, 3400 Maplewood Ave.; Tulsa: *A. K. Supply Co.*, 116 9th St.; Washington, D. C.: *Allen Mitchell & Co.*, 2117 E. St., NW.; Waterloo, Iowa: *Winterbottom Supply Co.;* Wichita: *U. S. Supply Co.*, 520 S. Commerce St.

National Radiator Corp., Johnstown, Pa., held a series of sales meetings in 12 cities during June introducing its new line of boilers and other heating products before a total attendance exceeding 4000 persons connected with the distribution of heating equipment. Meetings were under the supervision of *W. B. Montague*, sales promotion and advertising manager. Speakers included *T. A. Novotney*, manager of convector sales; *J. T. Ellis*, manager of steel boiler sales; *E. L. Redden*, assistant sales promotion and advertising manager, and Mr. Montague. A 42 ft. x 25 ft. traveling stage was used. Meetings were held in New York,

Philadelphia, Boston, Baltimore, Washington, Richmond, Pittsburgh, Cincinnati, Chicago, Milwaukee, Cleveland, and Buffalo.

Perfex Controls Co., Milwaukee, Wis., has appointed *T. H. Creears*, 1824 S. Hope St., Los Angeles, Calif., as its representative for southern California.

Rempe Co., 340 N. Sacramento Blvd., Chicago, has elected *George A. Rempe* president. *Lester Rempe* was named vice-president and treasurer; *C. Rempe Denver*, secretary; *J. O. Schultz*, general manager in charge of sales, and *George T. White*, general superintendent in charge of production.

Richardson and Boynton Co., New York, has appointed *William Iselin & Co.*, New York, factors, to handle its credits and collections. While factoring is one of the oldest forms of financing service and has been extended to a large number of industries, this is believed to be the first instance of its use in the heating trade. This move will do away with the credit, billing and collection departments previously maintained by the company, the key credit personnel being absorbed by Iselin.

H. A. Thrush & Co., Peru, Ind., has established a Detroit factory sales office as headquarters for the Michigan territory. *C. Lawrence Sargent*, for some years in charge of the company's engineering department, has been transferred to the sales department to take over the jurisdiction of this territory as direct factory sales engineer.

NEW CATALOGS

(Unless otherwise indicated the publishers of catalogs will supply copies on request without charge.)

The Allen-Bradley Co., Milwaukee, Wis., has published a 24-page, two-color booklet, entitled "The Story of the Solenoid Starter." The booklet points out, by questions and answers and sketches, the fundamental differences between the solenoid type motor starter and the clapper type starter. Points out the reasons why the solenoid starter was developed and discusses its performance.

Armstrong Cork Co., Lancaster, Pa., has published a handy pocket-size card giving detailed information for pipefitters and foremen of erecting crews relative to the proper spacing of cork covered pipe lines and instructions for hanging pipe. Tables on one side show the minimum distance between pipes to permit the application of cork covering of different thicknesses. Straps and trapeze types of pipe hangers are shown on the other side of the card with instructions for wall and floor sleeves and a table of covering sizes.

The Auer Register Co., 3608 Payne Ave., Cleveland, Ohio. A standard-size, 48-page catalog, No. 37, entitled "The Auer Register Book." This book is intended to be a complete guide to the selection of modern registers, intakes and grilles for both warm air heating and air conditioning. Gives descriptions, specifications, and lists prices of gravity registers, air conditioning registers and grilles.

These 3 floors

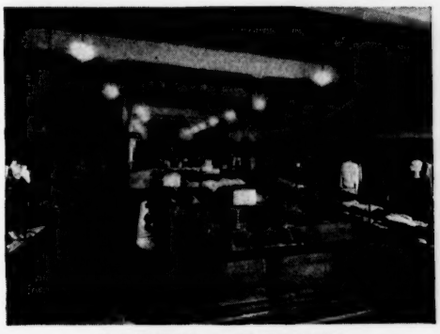
of the "Bon Marche," Canton, Ohio, are wholly Carbondale Air Conditioned . . .

● Entire comfort for shoppers

THIRD FLOOR

● Better business regardless of weather conditions

SECOND FLOOR



● Equipment that is economical and reliable

MAIN FLOOR

Let us explain the new and better Carbondale features.

CARBONDALE
DIVISION
WORTHINGTON PUMP AND MACHINERY CORPORATION
General Offices: HARRISON, NEW JERSEY
CA7-30 *Offices and Representatives in Principal Cities*

CARBONDALE

Important to AIR CONDITIONING

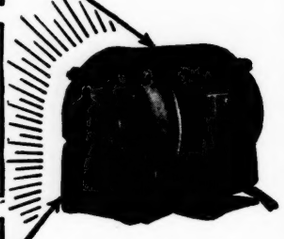
Contractors and Manufacturers

WITH the growing interest in air conditioning, the development and perfection of air conditioning equipment, and the increased number of installations, the demand for satisfactory air conditioning motors has greatly increased.

Motors to meet this demand are judged largely upon the basis of their efficiency, dependability, performance characteristics, quietness and appearance. Wagner motors are chosen by the leading motor buyers because they embody all the requisites of well-balanced design. Below is shown a Wagner motor equipped with the new type resilient annular-mounting. The boxes and arrows point out a few of its many features.

FRAME AND ENDPLATES are strong and rigid, and accurately machined — assuring permanent alignment of bearings and uniform air gap, two essentials for quiet operation.

STEEL - BACKED BABBITT - LINED BEARINGS are diamond-bored to secure bearing clearances small enough to avoid any possibility of excessive play and at the same time have ample clearance to afford a liberal oil film between shaft and bearing.



BASE consists of formed steel plate. There are no feet to break off in shipment or during mounting.

ROTOR is dynamically balanced to eliminate vibration and noise arising therefrom. The number and the dimensions of rotor slots are carefully chosen to minimize magnetic noise.

Wagner builds a complete line of motors. They are available in any standard horsepower, speed, and voltage rating; in many mechanical variations, such as, flange-mounting, resilient-mounting, double-shaft extension, etc.

On your next air conditioning installation, call in a Wagner sales-engineer for advice regarding the proper motor for the job. Just phone or write the nearest of our twenty-five branches for prompt consultation service.

Wagner Electric

6400 Plymouth Avenue • Saint Louis, U.S.A.

MOTORS • TRANSFORMERS • FANS • BRAKES

MS337-ILA

BAYLEY BLOWER CO., Milwaukee, Wis. A 12-page, standard-size catalog describing the Bayley line of fans, exhausters, air washers, blast heaters and unit heaters. Lists the outstanding features of each piece of equipment and shows a number of typical installations.

CARRIER CORP., 850 Frelinghuysen Ave., Newark, N. J. A booklet entitled "An Easy Way to Find How Quickly Carrier Air Conditioning Pays for Itself in Your Theater." Booklet is designed to enable theater owners to estimate in advance the cost of owning and operating an air conditioning system.

CHICAGO METAL HOSE CORP., Maywood, Ill., has published a 26-page, standard-size catalog on flexible metal hose application. Technical data are given on the use of flexible hose for saturated and superheated steam, for the conveyance of fluids and chemicals, and numerous special uses such as vibration absorbers for compressors, pumps and turbines, compensators for high temperature pipe lines and equalizer connections for gas burning furnaces.

FRICK CO., Waynesboro, Pa. A four-page standard-size bulletin on the Frick evaporative condensers for ammonia and Freon refrigerating systems. Discusses the advantages of evaporative condensers and presents the features and specifications of Frick condensers.

IRON FIREMAN MANUFACTURING CO., 3170 W. 106th, Cleveland, has published a four-color, 16-page booklet describing its new domestic, automatic coal stokers. The booklet describes the advantages and savings effected through use of automatically fired stokers. Anthracite and bituminous coal editions are available.

THE LINCOLN ELECTRIC CO., Cleveland, Ohio, has published a 10-page, standard-size booklet which describes its course in arc welding. The booklet is entitled "Building a Career in Arc Welding" and gives an outline of the course, tells who is eligible, and lists the fees for students.

NASH ENGINEERING CO., South Norwalk, Conn., has published a standard-size, eight-page bulletin, No. 267, on the Jennings unit type vacuum heating pump. This pump is designed for use on return line vacuum heating systems or in any service where a liquid and a gas are handled together. Bulletin describes the features of the pump, gives dimensions, ratings, capacities and power requirements.

W. H. NICHOLSON & CO., 12 Oregon St., Wilkes-Barre, Pa. A six-page bulletin, No. 337, on the Nicholson industrial steam trap. Describes and gives specifications, dimensions, and list prices of four types of industrial traps. Also presents sectional illustrations of the four types of traps and shows recommended piping diagrams.

PERFEX RADIATOR CO., 415 W. Oklahoma Place, Milwaukee, Wis., has published a standard-size, eight-page catalog on the Perfex unit coolers for 1937. Bulletin describes the various types of unit coolers made by this company and gives specifications and dimensions. It also gives data on the Perfex unit heaters when used as unit coolers.

ROOTS-CONNERSVILLE BLOWER CORP., Connersville, Ind., has published a bulletin, No. 260-B13B, describing its line of shallow well water systems. This type

of system utilizes the type T turbine pump which has only one moving part. Bulletin lists outstanding features, describes method of operation, and gives specifications on six models.

SURFACE COMBUSTION CORP., Toledo, Ohio, has published an attractive standard-size booklet entitled "Life As You Would Have It." The booklet describes the advantages of the Janitrol gas heating equipment and shows how the modern American family can receive benefits from this type of heating through the entire 24 hr. of the day.

COMING EVENTS

JULY 12-31, 1937. Intensive Course in Air Conditioning, Purdue University, Lafayette, Ind. Prof. G. A. Young, Head, School of Mechanical Engineering.

JULY 15, 1937. 3rd Regular Meeting, Industrial Unit Heater Association, Hotel Cleveland, Cleveland, Ohio.

AUGUST 3-7, 1937. Power Show and Mechanical Exposition, The Universal Craftsmen Council of Engineers of the World, Hotel Stevens, Chicago.

AUGUST 22-28, 1937. National Warm Air Heating and Air Conditioning Week. Headquarters, Suite 635, 407 S. Dearborn St., Chicago, Ill.

AUGUST 30-SEPTEMBER 3, 1937. National Convention, National Association of Power Engineers, Inc., Jefferson Hotel, St. Louis, Mo.

SEPTEMBER, 1937. Quarterly Meeting, Stoker Manufacturers Association, Chicago, Ill.

SEPTEMBER 27-OCTOBER 1, 1937. 19th Annual Convention, American Gas Association, Hotel Cleveland, Cleveland, Ohio.

OCTOBER 4-9, 1937. Chicago Exposition of Power and Mechanical Engineering, International Amphitheater, Chicago. Charles F. Roth, Grand Central Palace, New York.

OCTOBER 5-8, 1937. 66th Annual Meeting, American Public Health Association, Hotel Pennsylvania, New York.

OCTOBER 18-22, 1937. 18th Annual Meeting, American Welding Society, Hotel Traymore, Atlantic City, N. J.

OCTOBER 18-22, 1937. National Metal Exposition (including Welding) Convention Hall, Atlantic City, N. J. W. H. Eisenman, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 9-12, 1937. 18th Annual Meeting, American Petroleum Institute, Stevens Hotel, Chicago.

DECEMBER 6-10, 1937. Annual Meeting, American Society of Mechanical Engineers, New York.

DECEMBER 6-11, 1937. 16th Exposition of Chemical Industries, Grand Central Palace, New York.

JANUARY 24-28, 1938. 5th International Heating and Ventilating Exposition, Grand Central Palace, New York. Charles F. Roth, Grand Central Palace, New York.

JANUARY 24-28, 1938. 44th Annual Meeting, American Society of Heating and Ventilating Engineers, New York.

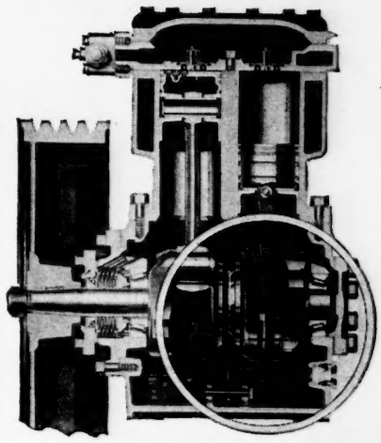
JANUARY 24-28, 1938. Annual Meeting, National Warm Air Heating & Air Conditioning Association, Hotel Roosevelt, New York.

JANUARY 24-28, 1938. 33rd Annual Meeting, American Society of Refrigerating Engineers, Hotel Roosevelt, N. Y.

APRIL 11-16, 1938. Mechanical Equipment Show, Textile Hall, Greenville, S. Car. William G. Sirrine, President, Textile Hall Corp., Greenville, S. Car.

DECEMBER 5-10, 1938. 13th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.

CURTIS
Condensing Units



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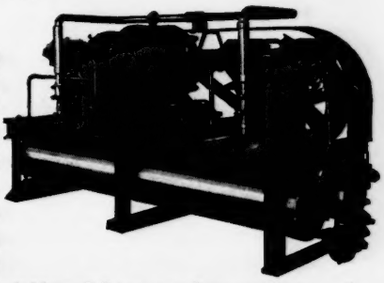

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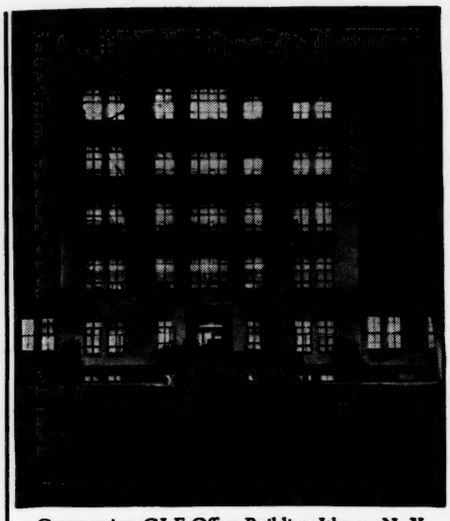


Cooperative GLF Office Building Ithaca, N. Y.

NEW GLF BUILDING GETS MODERN HEATING

American Warming & Ventilating Co. Installs Webster Moderator System

Concealed Webster Radiation

Ithaca, N. Y.—Built during 1936, the modern, five-story office building of the Cooperative Grange League Federation stands as a tribute to the careful planning and sound business management of the Cooperative officials.

Working on a limited budget, officers of the GLF sought long life and low maintenance cost in selecting equipment.

Study of the performance records of Webster Systems of Steam Heating in scores of installations convinced Grange officials that the Webster Moderator System was the soundest possible investment for the heating of their new building.

The Webster Moderator System provides **balanced** heating service. Heat is delivered continuously to all radiators and the entire building is comfortably heated regardless of the severity of the weather and without overheating in mild weather. Heating costs are held continuously at a minimum.

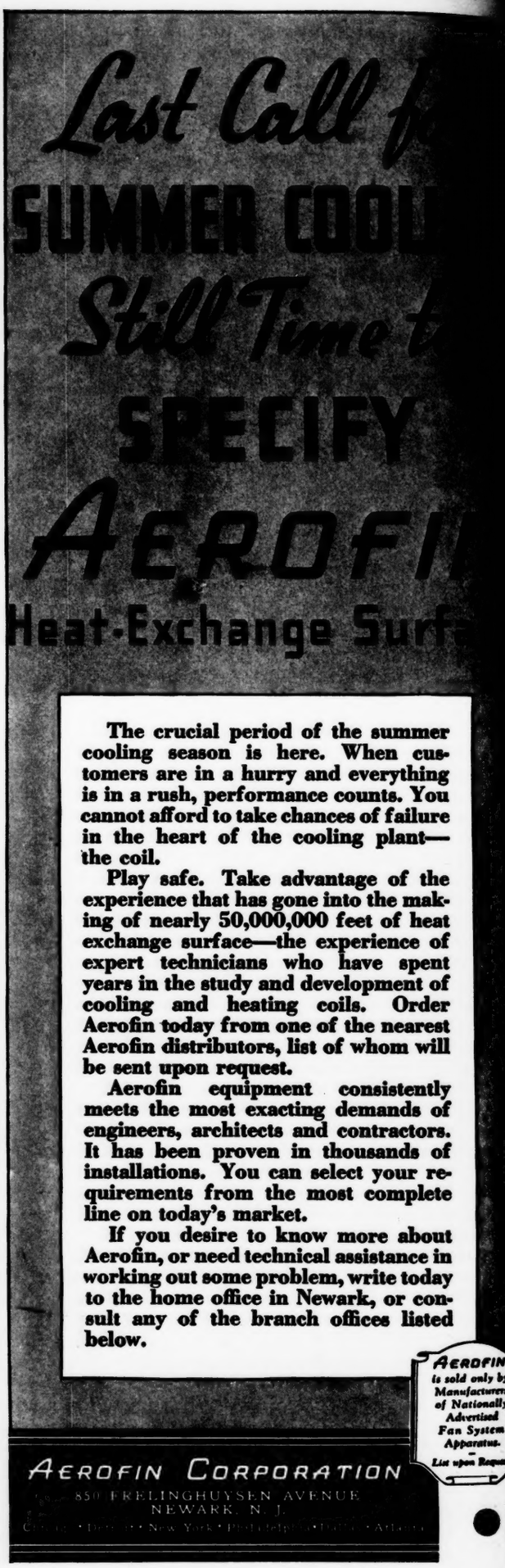
The installation includes 70 concealed Webster System Radiators. The grilles of these "out-of-the-way" concealed radiators harmonize with the modern interior and increase available floor space. All cast-iron radiators used in the building are equipped with Webster Three-Point Valves to insure maximum flexibility.

Two Webster Boiler Protectors guard against accidental low water in the low-pressure heating boilers. If water is lost from a boiler accidentally, the Webster Boiler Protector automatically maintains emergency level and provides the operator with definite indication that water has been lost.

The Webster System was installed in the GLF Building by the American Warming & Ventilating Co., well-known heating contractors of Elmira, N. Y. The building was designed by Arthur N. Gibb, a leading Ithaca architect.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address WARREN WEBSTER & CO., Camden, N. J. Pioneers of the Vacuum System of Steam Heating Representatives in 60 principal U. S. Cities— Est. 1888

WEBSTER MODERATOR CONTROL "Control by the weather"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